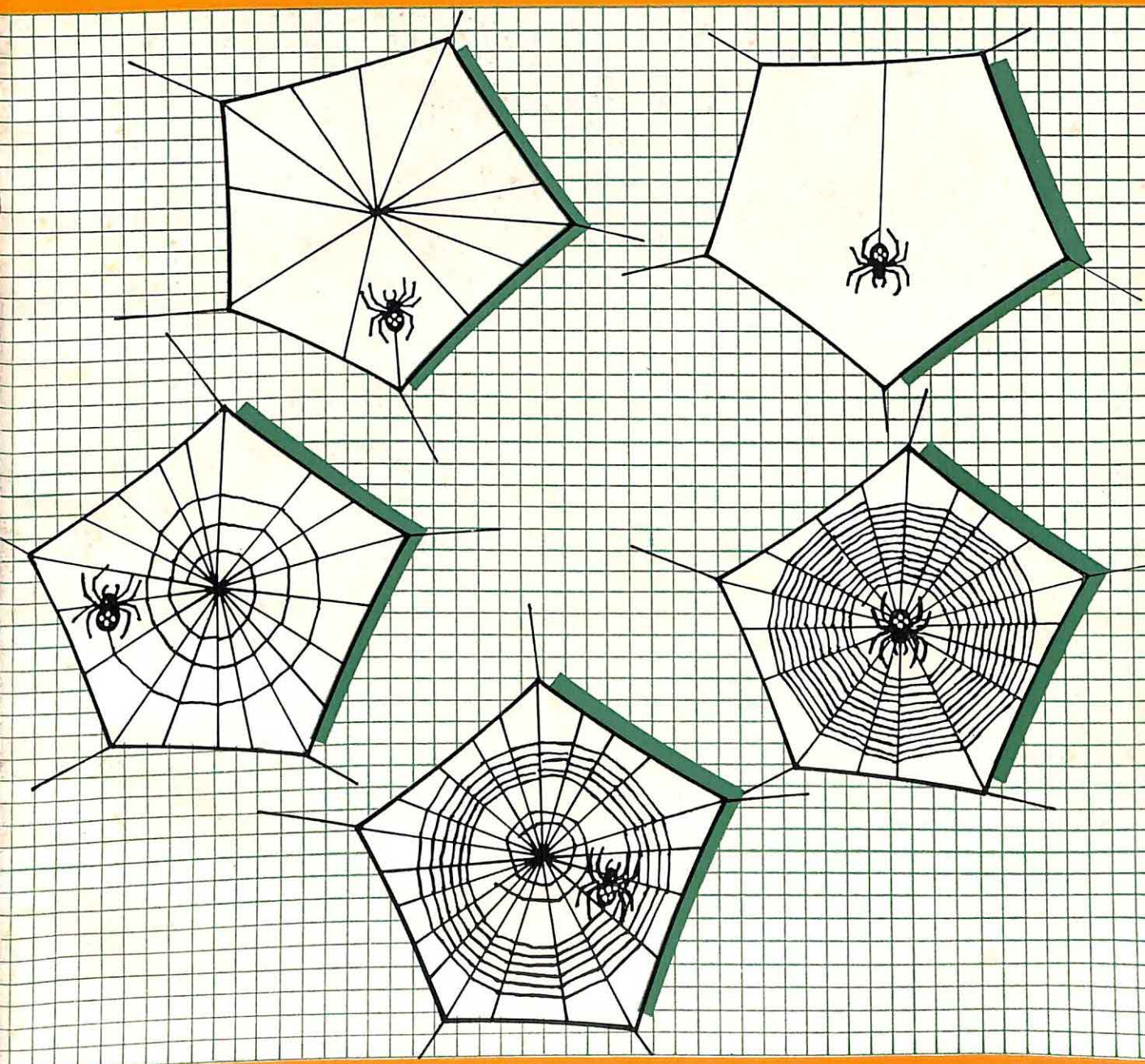
Understanding Science

BIOLOGY

Class VI



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BIOLOGY

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Preface

The Understanding Science series conforms to the guidelines laid down by the NCERT. While planning these books, our aim has been not only to adhere to the syllabus but at the same time, present the relevant concepts in biology in a lucid and absorbing manner in order to stimulate the interest of the student.

Keeping in mind the level of understanding of the student and his inherent curiosity at this age, the facts have been presented as an answer to his queries on himself and his environment, and also on their interaction and interdependence. Relevant illustrations supplement the topics and reinforce the concepts.

Easy-to-do activities have been included to encourage the students to collect, tabulate and interpret data. Carefully planned exercises at the end of each chapter enable the student to recapitulate and help the teacher to assess the comprehension of the student.

We hope this series enables the students to realise and appreciate the facts that a proper understanding of the subject is crucial to the very existence of mankind.

SHYAMLA MENON
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PROMILA THEODORE

September 1988

Contents

Preface *iii*

1. The Living World **1**
Living and Non-living
Life around Us
Protoplasm—The Basic Substance of Life
Life Functions
Differences between Animals and Plants
Exercises

2. Origin of Life **15**
How Life Began
Organic Evolution
Classification and Nomenclature
Exercises

3. Microscopic Structure of Living Things **24**
Microscope
The Cell
From Cells to Individuals
Exercises

4. Structure and Function in Plants **30**
The Seed
Flowering Plants
Parts of a Flowering Plant
Reproduction in Plants
Exercises

5. Structure and Function in Animals **46**
The Digestive System
Respiratory System
The Excretory System
The Skeletal System
Circulatory System
Reproductive System
Diseases
Care of the Body
Exercises

6. Food and Health **56**
The Need for Food
Nutrients in Food
Balanced Diet
Preservation of Food
Exercises

7. Adaptability to the Environment **62**
Basic Rules that Govern Life
Natural Adaptations
Limits of Adaptation
Exercises

8. Interdependence and Balance in Nature **69**
Man's Dependence on Plants and Animals
Interdependence in Nature
Balance in Nature
Interdependence and Interaction
Exercises

The Living World

1.1 Living and Non-living

Of all the wonders of the universe the most fascinating are living beings themselves. Living creatures can be observed everywhere in our houses, in the gardens and in and around our neighbourhood, such as ponds and woods.

In our houses we have pet animals such as dogs, cats, or cows. Besides these we see cockroaches in the kitchen, and flies and mosquitoes in plenty, specially during the rainy season. Birds such as crows, sparrows and pigeons visit our houses in search of food. We may also have some potted plants in our house. Plants also are living things.

In the garden we find grasses, flowering plants, ferns, trees, birds, worms and insects (Fig. 1.1a).

In a pond there are fishes, frogs, snails, water plants, water grass, lotus, etc, (Fig. 1.1b).

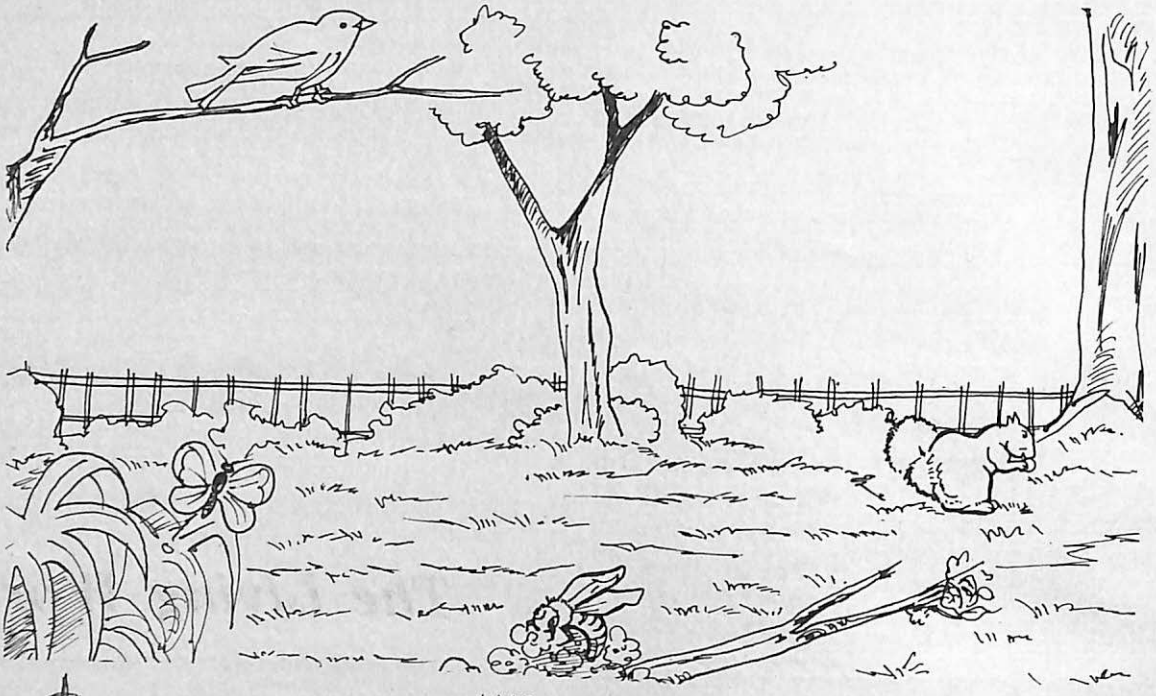
If you have visited a zoo you might have seen animals such as lions, tigers, giraffes monkeys, peacocks and many others.

What is Biology?

Before we study more about living things we must be able to recognise them. Observe your pet dog or cat and compare it with a rock. A dog can bark, eat, breathe and move on its own. You can also command a dog to sit, run or to perform some other tricks. It can also give birth to little pups. But a rock cannot do any of these, because rock is not living, it has no life in it.

The rose plant that you grow in your garden and your pet dog, both are living. Yet you find that they are different from one another in their size, movement, method of obtaining food,etc. Can you list some more differences?

The study of these living things is called **Biology.** In Greek *Bios* means 'life' and *logos* means 'science' or 'study'. Together they form the word 'Biology' which means



(a) Life in a garden.

(b) Life in a pond.

Fig. 1.1

the 'science of life'. It is the study of both plants and animals. In Biology you study how these living things grow, eat, breathe etc., how they are useful to us, how they are harmful and can cause diseases to us and destroy our crops. We also study how we can control them and protect ourselves and our crops. Biologists are the scientists who study all about living things.

The Life Cycle

When a human baby is born the parents nurture it and look after all its needs. The baby grows into an infant and then gradually matures into an adult. Growth slows down and aging starts till death comes as an end. It is the same in the animal world. Plants also behave in a similar manner. A sun flower seed germinates into a small plant. This plant grows bigger and bears flowers. Flowers grow into fruits. Fruits bear seeds, which are dispersed to grow again into a new set of plants, while the parent plant dies.

All the dead animals and plants finally break down into substances that mix in the soil to become a part of the soil.

All living things such as plants and animals pass through this cycle of birth, growth and death. Non-living things such as rocks, and man-made objects such as tables, chairs, machines or houses, do not pass through this cycle of birth,growth and death. However, a wooden table is made from the trunk of a tree which was once alive, but is now dead. A wooden table is therefore a **dead** object.

Preservation of Life

Each living organism possesses a condition called **life.** Animals and plants are endowed with life by their parents. They in turn pass on this life to their offspring. Thus life is preserved age after age through offsprings. You might compare this with the preservation of fire by lighting new fires with it, before it extinguishes. In this way the fire can be preserved endlessly. Similarly life too is preserved from generation to generation.

1.2 Life around Us

Life in nature cannot exist alone. There are various types of plants and animals living in close relationship with each other and with the surroundings, such as soil, air and water. *The living and non-living surroundings form the environment of a living being.* Environmental conditions vary in different areas on the earth. Hence plants and animals vary along with them. This is why our earth is the home of so many different kinds of plants and animals *Various forms of plants and animals are found in the soil, in ponds, in the sea,etc.*

Life in a Pond, Lake or River (Fig. 1.1b)

Fishes of various sizes, such as rohu, salma, or katla, are present in ponds, lakes and rivers. Besides these, can be seen thread-like green plants called **algae**. Rooted plants such as lotus, trapa (*singhara*) and water hyacinth are also present. Various types of insects also breed in water. At the bottom of a pond we may find snails, worms and turtles as well.

Life in the Soil (Fig. 1.2)

You must have seen earthworms coming out of the soil during the rainy season, when their burrows get filled with water. Ants and white ants have their colonies in

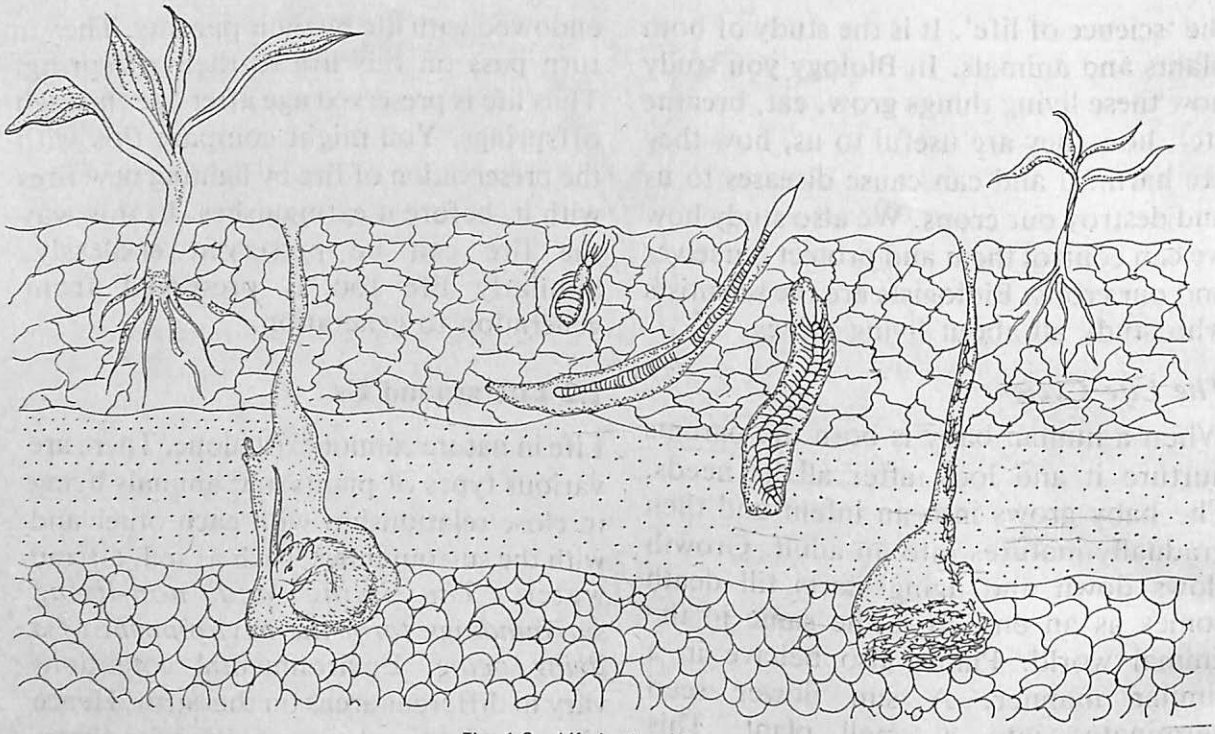


Fig. 1.2 Life in the soil.

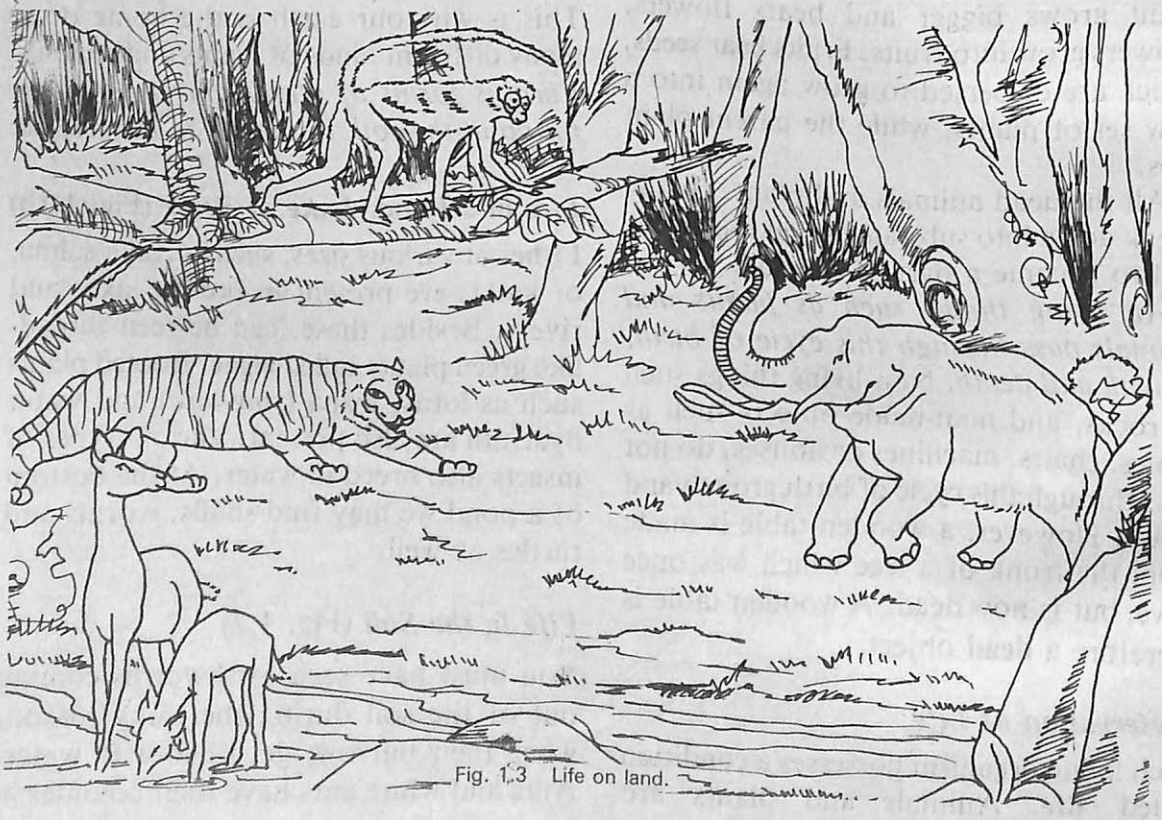


Fig. 1.3 Life on land.

the soil. Various types of insects are also found in the soil. Fungus grows in plenty in wet soil. In addition to these, rats and rabbits make their burrows in the soil. The burrows of rats are also shared by snakes.

Life on Land (Fig. 1.3)

Trees, shrubs and herbs all grow on land. Pines, cedrus, oak, and firs are very tall trees found growing in mountains. Giant Sequoia trees are the tallest trees in the world. They are found in California (USA). Peepal, banyan, mango, neem, and gul mohur are trees found in the plains. In the deserts of Rajasthan we find small trees of acacia (*kikar*) and some bushes of acacia. Many animals such as snakes, rabbits, rats, peacocks, and mongoose are common in plains and deserts. Near the sea shore coconut trees, jack fruit trees and palm trees are common. In forests such as the Gir forests of Gujarat, wild animals such as lions, tigers and elephants are common. Kangaroos and platypus are found in Australia. Kiwi, a flightless bird, is found in New Zealand. Zebra is common in Africa. Besides these there are thousands of types of plants and animals found in various places on land.

Life in the Sea (Fig. 1.4)

The smallest living organism—the bacteria—and the largest animal—the whale—are both found in the sea. There are also various other animals of varying sizes and forms such as sharks, rays, dolphins, sea horses, sea urchins, etc. Jelly fishes are common in the shallow sea shore. You can see them in plenty at the Kolva beach in Goa. A jelly fish looks like a thick mass of jelly.

There are green, brown and red floating plants called sea weeds in the sea. They form the food of various sea animals.

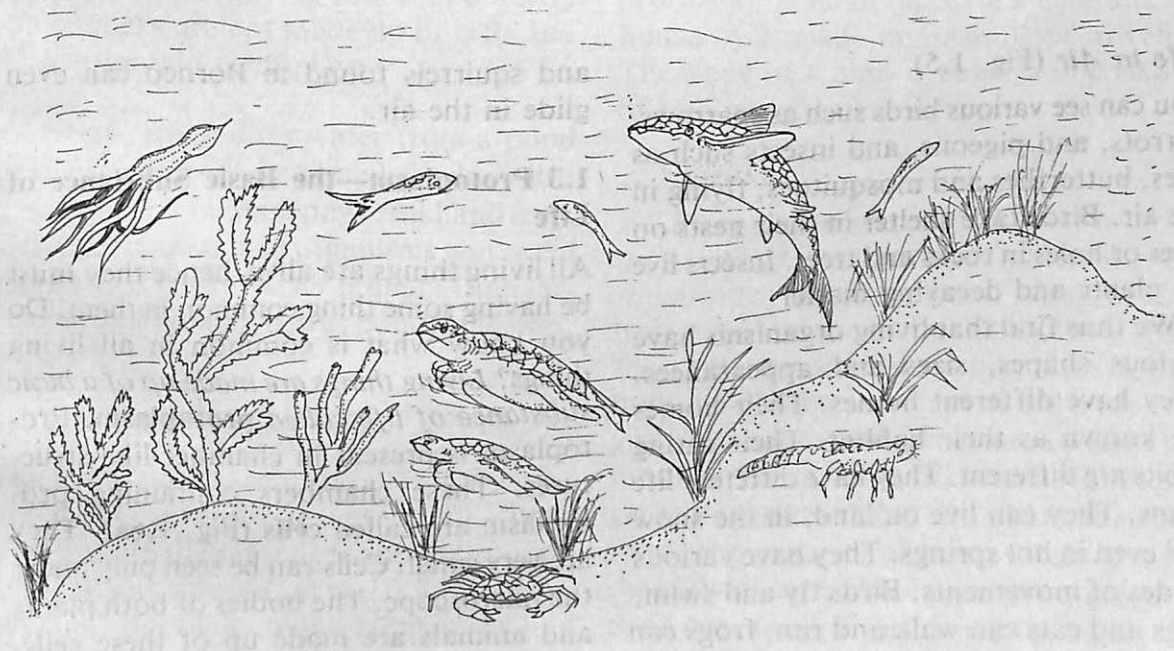


Fig. 1.4 Life in the sea.

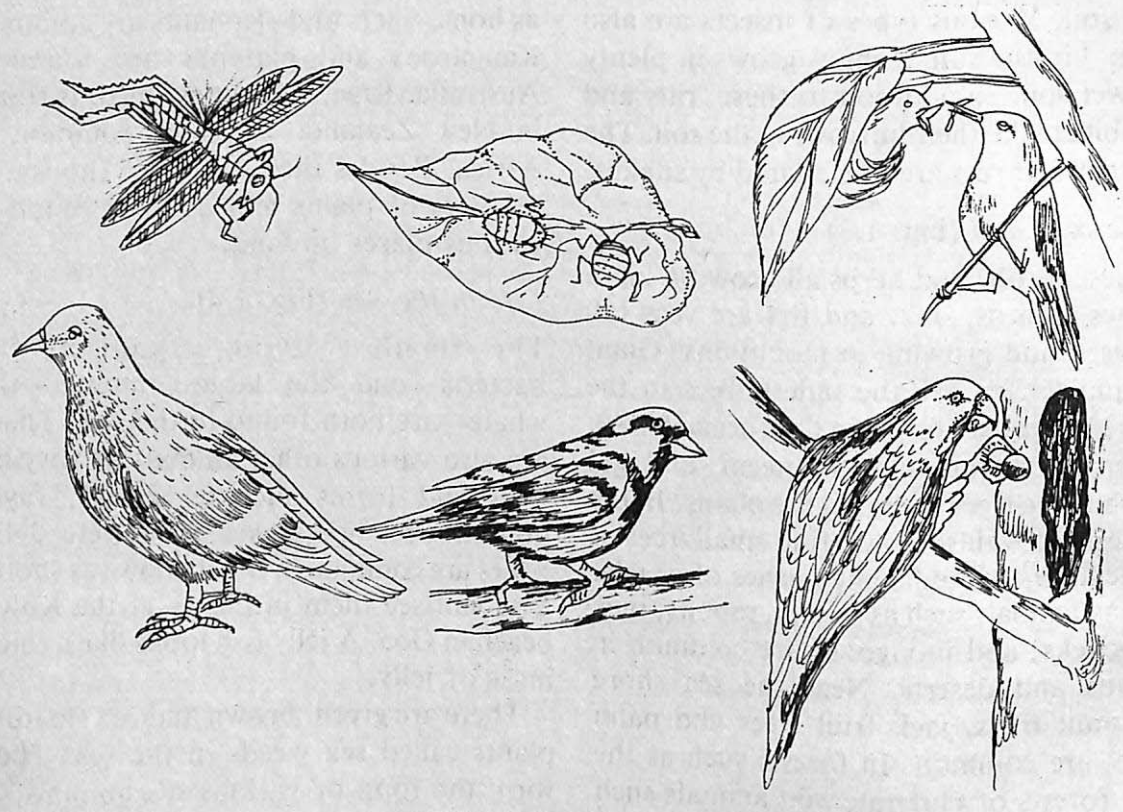


Fig. 1.5 Birds and flying insects.

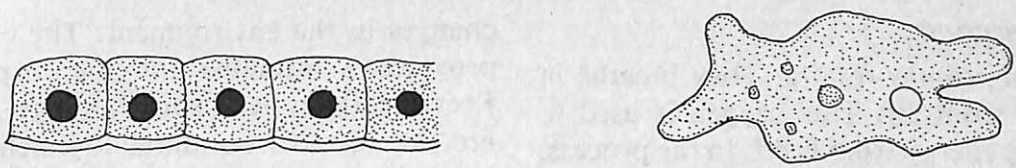
Life in Air (Fig. 1.5)

You can see various birds such as sparrows, parrots, and pigeons, and insects such as bees, butterflies and mosquitoes, flying in the air. Birds take shelter in their nests on trees or holes in rocks and trees. Insects live on plants and decaying matter.

We thus find that living organisms have various shapes, sizes and appearances. They have different homes. Their homes are known as their **habitat.** Their eating habits are different. They have different life spans. They can live on land, in the snow and even in hot springs. They have various modes of movements. Birds fly and swim, dogs and cats can walk and run, frogs can hop, snakes can crawl. Some snakes and squirrels found in Borneo can even glide in the air.

1.3 Protoplasm—the Basic Substance of Life

All living things are alive, hence they must be having some thing common in them. Do you know what is common in all living things? *Living things are made up of a basic substance of life called* **protoplasm.** Protoplasm is present in chamber-like structures. These chambers containing protoplasm are called **cells** (Fig. 1.6a). They are very small. Cells can be seen only under the microscope. The bodies of both plants and animals are made up of these cells. Even very small living organisms, such as



(a) Cells make up the bodies of living beings.

(b) A single celled organism—amoeba.

Fig. 1.6

bacteria, which we cannot see with the naked eye, contain protoplasm. Sometimes you can see a white cottony growth on stale bread and other eatables. This growth is called **fungus**. This fungi too has protoplasm. In a pond you may see green thread-like structure or green scum. These are called **algae**. They too possess protoplasm. If you see a drop of water from a pond under a microscope you may see very small living organisms moving about. These are single-celled organisms called **protozoa** (Fig. 1.6b) and they too have protoplasm. Non-living things like water, soil or rocks are not made up of cells and do not contain protoplasm.

*Activity*1: Bring dirty water from a pond in a glass. Pour it in a shallow glass dish and observe it under a powerful hand lens. Draw the diagrams of organisms you see in this water. Observe water brought from different places (ditch, drain, pond, lake, tap, well, etc.).

1.4 Life Functions

The living substance, protoplasm, is composed of several elements. All these elements are the same as found in the non-living world, for e.g., in the soil, in air or in water. But their combination in the living beings are very complex.

All living organisms perform certain activities. These activities of life are known as **life functions**. When these life functions or activities stop, life ceases and the living organism dies.

Let us now list the properties and life functions of living organisms.

1. Cellular Structure

All living things, animals and plants are made up of cells (Fig. 1. 6a). The cell is known as the unit of life. Cells can be seen only under the microscope. The body of a protozoan is made up of a single cell. A house fly is made up of millions of cells. The body of a man is larger and consists of billions of cells.

2. Nutrition

All living organisms require food to produce energy and to build up new protoplasm for the growth and repair of the body. A child grows by taking food. The food gets converted to protoplasm in the body and becomes a part of his body. A growing child owes his increased weight to his diet of eggs, milk, bread,etc. But these get so transformed that you will not be able to see the particles of these substances in the body of the child. Green plants prepare their own food with the help of sunlight, carbon dioxide and water.

3. *Respiration*

All living things respire. They breathe in oxygen from air. This oxygen is used to produce energy from food. In the process, carbon dioxide is formed. Living organisms breathe out this carbon dioxide.

4. *Excretion*

All living things excrete, i.e., they give out waste materials from their body. For example carbon dioxide is breathed out, and urine is passed out from the body.

5. *Reproduction*

All living organisms have the ability to reproduce their own kind (Fig. 1.7). Men, snakes, cattle, insects and all other living beings produce young ones. These young ones grow and develop into adults. Trees yield seeds and in course of time these seeds grow to become trees.

6. *Response to Stimuli*

Living things respond to changes in the environment. If your hand touches a hot object you respond by quickly withdrawing your hand. A plant bends towards sunlight (Fig. 1.8). Thus living beings respond to changes in the environment. The change provides a **stimulus** for the response. Pressure, light, heat, sound, hunger, fear, etc., are some of the stimuli to which living beings respond in characteristic ways.

Fig. 1.7 Reproduction in hen.

7. *Movements*

All living things show movements. Animals move from place to place in search of food and shelter. Plants do not move from place to place. But their roots move in the soil to absorb water, and the plant bends towards sunlight (Fig 1.8).

8. *Form and Size*

All living things have certain form and size. An elephant is huge and has a trunk. A mushroom is small and has an umbrella-type structure. It is because of this feature that we can distinguish a rose bush from a neem tree, or a dog from a horse.

9. *Life Cycle*

All living things have a definite life cycle (Fig. 1.9). They grow from birth (or germination) to maturity, old age and

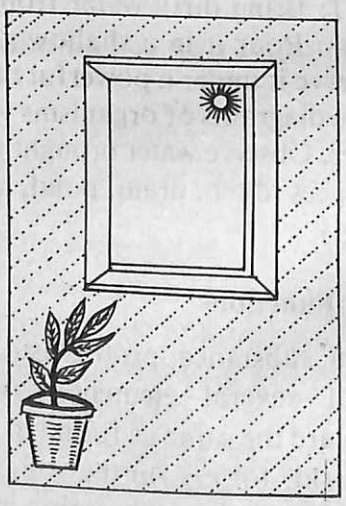


Fig. 1.8 A plant responds to the stimulus of sunlight by bending towards it.

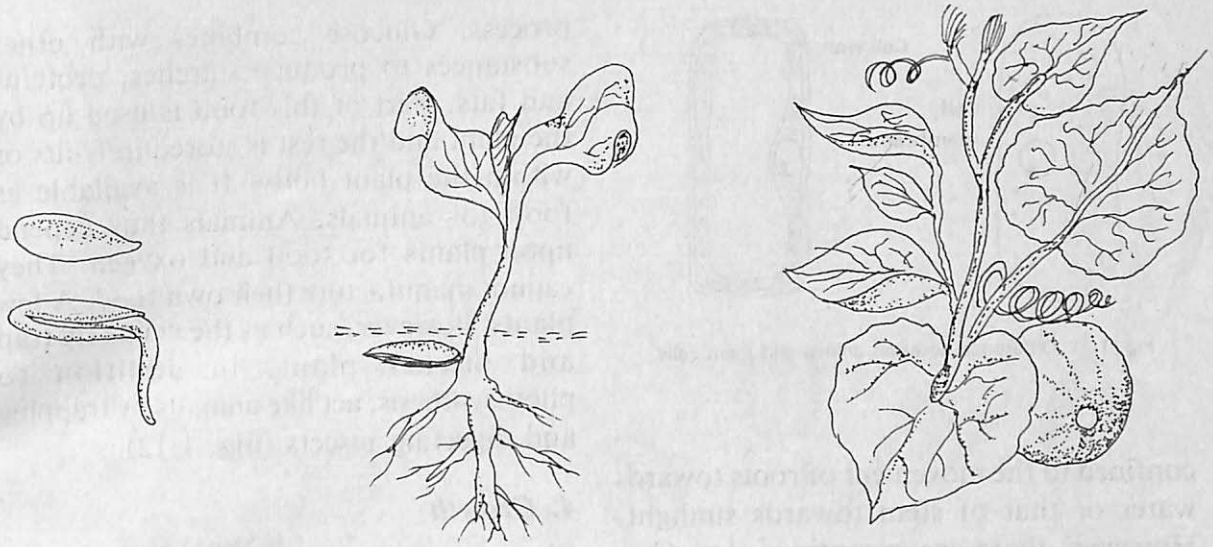


Fig. 1.9 Reproduction and life cycle of a cucurbita plant.

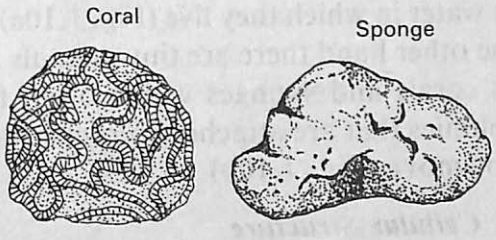
finally death. They also have a definite life span. A dog lives for 10-15 years, a man can live for more than 100 years, a tortoise for 150 years , a rat for 3 years, while an elephant lives for about 100 years. Trees have a long life span. A red wood tree can live for over a thousand years. There are plants which live only for one season, e.g. calendula, lady's finger or sunflower.

1.5 Differences between Animals and Plants

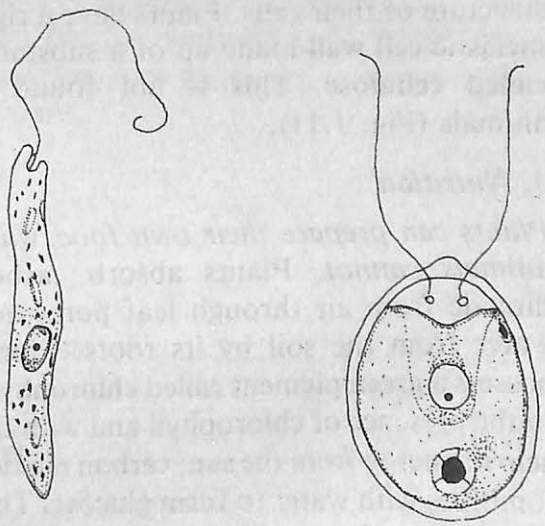
We have seen that plants and animals possess the same life substance and carry on the same life functions. However, they show some differences also. Let us discuss about them.

1. Movement

Most animals move about freely while the vast majority of plants are fixed in one place. Animals move in search of food and to protect themselves from natural enemies. Movement in plants is very slow. It is



(a) Animals that do not move.



(b) Plants that move freely.

Fig. 1.10

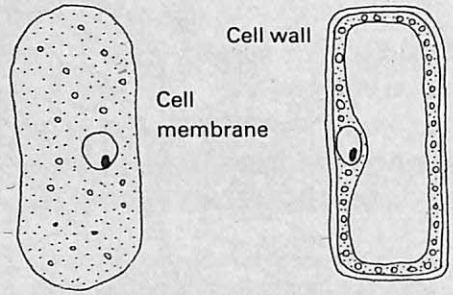


Fig. 1.11 Difference between animal and plant cells.

confined to the movement of roots towards water or that of stem towards sunlight. However, there are exceptions also. Certain microscopic plants such as the **chlamydomonas** and **diatoms** move about in water in which they live (Fig. 1.10a). On the other hand there are tiny animals such as corals and sponges which often form colonies that are attached to rocks and do not move (Fig. 1.10b).

2. Cellular Structure

Animals differ from plants in the outer structure of their cells. Plants have a rigid inelastic **cell wall** made up of a substance called **cellulose**. This is not found in animals (Fig. 1.11).

3. Nutrition

Plants can prepare their own food while animals cannot. Plants absorb carbon dioxide from air through leaf pores and water from the soil by its roots. Plants possess a green pigment called **chlorophyll**. In the presence of chlorophyll and with the help of energy from the sun, carbon dioxide combines with water to form glucose. This process is known as **photosynthesis**. It takes place in green leaves. Oxygen is given out to the atmosphere as a result of this process. Glucose combines with other substances to produce starches, proteins and fats. Part of this food is used up by the plant and the rest is stored in fruits or within the plant body. It is available as food for animals. Animals thus depend upon plants for food and oxygen. They cannot manufacture their own food. A few plants, however, such as the venus fly trap and pitcher plant, in addition to photosynthesis, act like animals by trapping and digesting insects (Fig. 1.12).

4. Growth

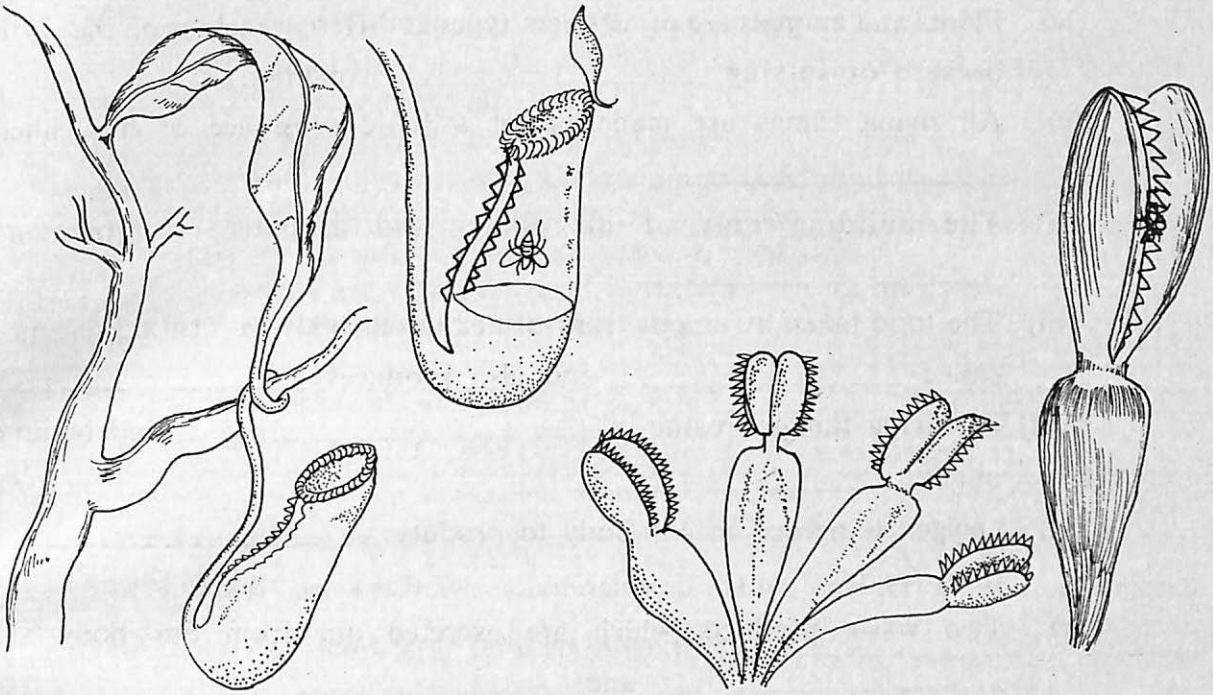
Plants continue to grow throughout their lives. Their growth is due to growing zones present at certain fixed regions such as root and stem tips. Animals, however, grow upto a certain age only and stop growing after that. They do not have fixed growing points. All the parts of an animal grow at a uniform rate.

5. Colour

Plants are generally green in colour due to the green chlorophyll pigments. Animals have different types of pigments and are therefore variously coloured. Our skin has **melanin pigment** which gives colour to our skin

Activity 2: Observe living things at home, in school, in a garden and in a pond and prepare separate lists of these plants and animals. How do these animals get their food? Before you start observing you must have the following things.

1. A small magnifying glass marked 10X which will magnify anything you see through it ten times. A house fly will look 10 times bigger. If you observe a drop of water from a ditch or a pond throuh it, you



(a) Pitcher plant

(b) Venus fly trap.

Fig. 1.12 Some plants trap and digest insects.

may see small organisms moving in water and very small green plants.

2. A small note book and pencil for keeping record of where you went, what you saw and also to make diagrams of the plants or animals you observed.

3. Plastic containers, to keep living organisms such as insects, to observe them at home.

EXERCISES

1. Fill in the blanks.
   (i) All living things pass through the cycle of _____ , _____ and _____ .
   (ii) Life on earth is preserved through _____ after _____ of plants and animals.
   (iii) There is interdependence between the living and _____ world.

(iv) Plants and animals are of different types at different regions on the earth because of varying _____ conditions.

(v) All living things are made up of a basic substance of life called _____

(vi) The building unit of all plants and animals is known as _____ .

(vii) The food taken by us gets transformed in our body to form a substance called _____ and also produces _____ .

(viii) All living things breathe in _____ and breathe out _____ .

(ix) Oxygen is needed in our body to produce _____ from food.

(x) Two waste products which are excreted out from our body are _____ and _____ .

(xi) Living things _____ to changes in the environment.

(xii) Animals move from place to place in search of _____ and _____ .

(xiii) The time period between birth and death of any living organism is known as its _____ _____ .

(xiv) Living things can be distinguished from one another due to their _____ and _____ .

(xv) Animals produce young ones while plants produce_____ .

(xvi) Plants make food from water and _____ in presence of green pigments called _____ with the help of _____ energy.

(xvii) The pigment found in human skin is called _____ .

(xviii) The worm which comes out of the soil as its burrows get filled with water is _____ .

(xix) _____ is a single celled organism.

(xx) _____ is a plant which moves freely. _____ is an animal which cannot move.

2. Write true or false. Correct the false statements.
   (i) All animals and plants die and break down into substances that become a part of the soil and air.
   (ii) Plants do not respond to the environment.
   (iii) Plants do not need food while animals need food for growth.
   (iv) Plants contain green pigments in their cells.
   (v) Animals do not have any pigments in their cells.
   (vi) Growth in plants is restricted to the tips of root and stem.
   (vii) We can see cells with our naked eyes.

3. What is a habitat of an animal or a plant? _____

4. Give two differences between animals and plants, one pertaining to its cellular structure and another to cellular functions. _____

5. (i) What is the difference between a living and a dead animal? _____

   (ii) What is the difference between a non-living and a dead animal? Is a wooden table non-living or dead? _____

6. Why are animals dependent upon plants for their food? _____

7. Plants do not eat food. From where do they get food for their growth? ____

_____

_____

8. What is special about pitcher plant and venus fly trap plants? _____

_____

_____

9. Tick mark the living things in the following list.
(i) stone (ii) cottony growth observed on stale bread (iii) wood (iv) fan (v) green filaments floating in water (vi) soil (vii) gul mohur tree. (viii) jelly fish (ix) snail (x) grass (xi) dry leaves.

10. Match the following.

Acacia	Gir forests of Gujarat
Palm tree	Sea shore
Lotus plant	Soil
Cedrus tree	Deserts of Rajasthan
Fungus	Ponds
Lion	Africa
Zebra	Mountain
Whale	Deep Sea
Earthworm	Rotten bread and fruits

2

Origin of Life

In the previous chapter you learnt about living things. Perhaps you are wondering how life started on this earth. What did the first organism look like? Where did they live? Where did they come from? We can talk of various possible ways in which life could have started on the earth.

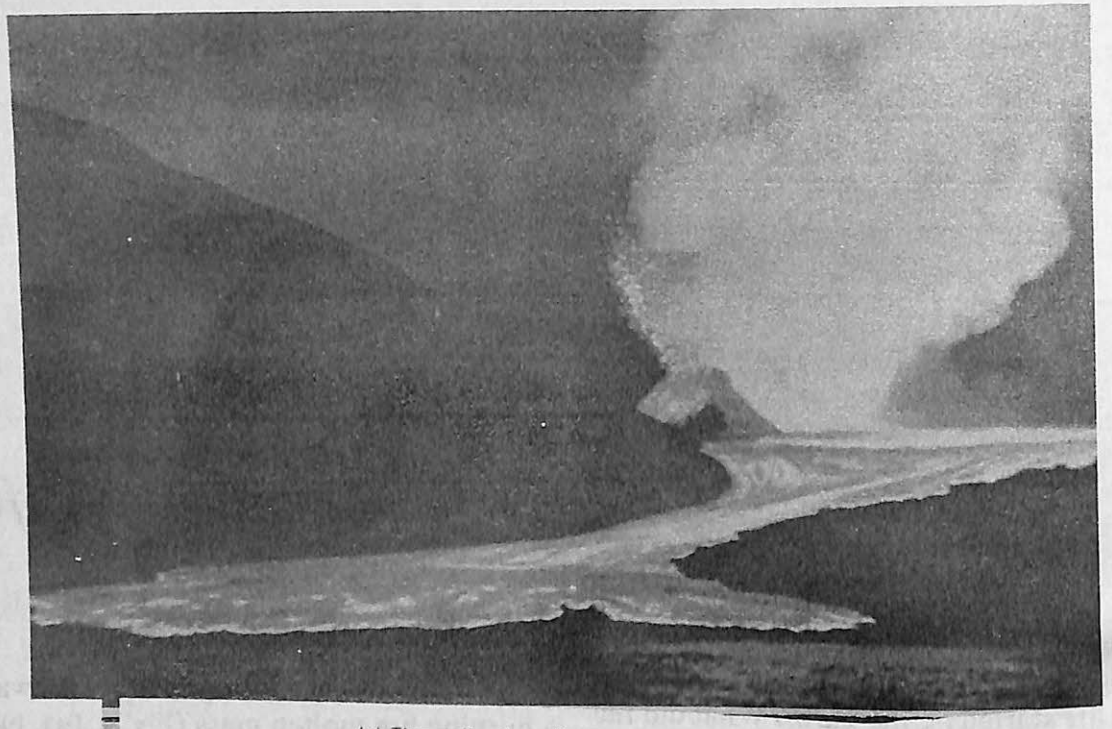
Some of the possibilities are: (1) Living things could always have existed on the earth; (2) Life could have come from some other planet; (3) Life could have originated on the earth at some remote time in the past. Scientists now exclude the first possibility. We know that hundreds of millions of years back the earth was a very hot place, on which nothing could have lived.

If life came from a distant planet, how did it come from there? How did life originate on the other planet? Scientists are carrying out experiments to explore life on other planets.

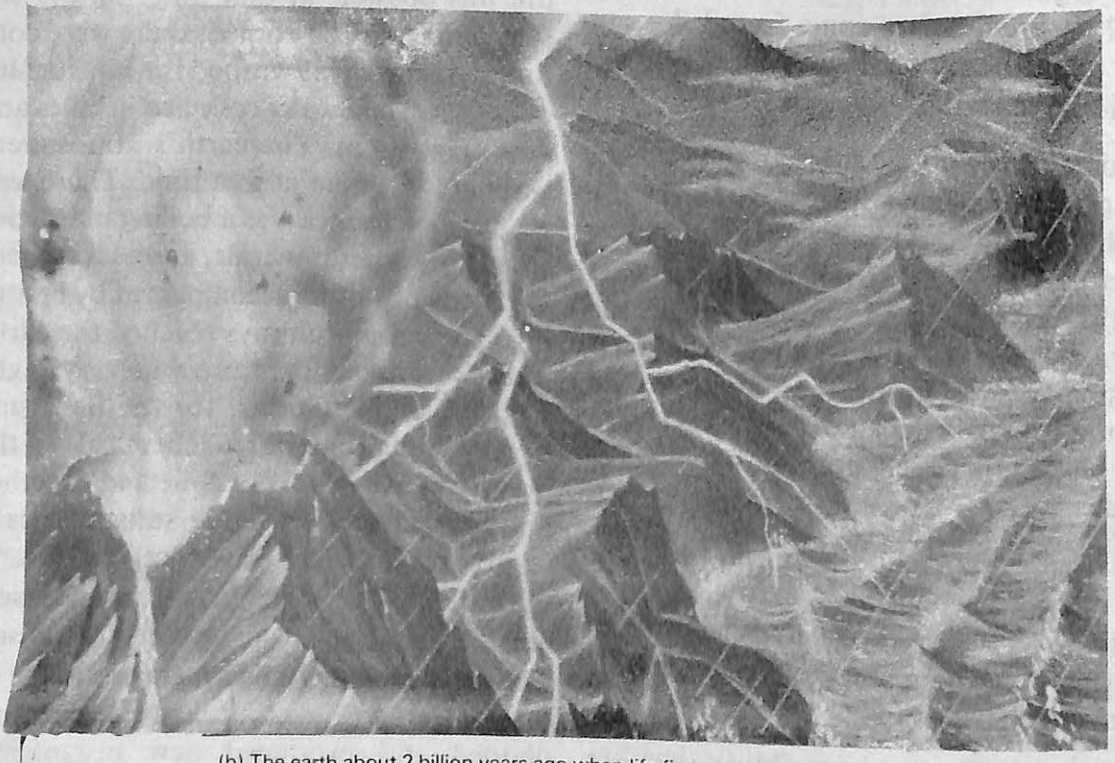
Let us see the third possibility that life orginated on the earth at some remote time.

2.1 How Life Began

About five billion years ago, the earth was a burning hot molten mass (Fig. 2.1a). No life was possible at that time. Slowly the earth cooled. As it cooled, there were continuous rains. This washed the hot surface of the earth and water collected in lakes and seas (Fig. 2.1b). The earth's atmosphere was very different at that time. There was no oxygen. The sea was a boiling mass consisting of water, minerals, gases etc. There were violent storms accompanied by lightning. The strong sun rays reached the earth directly. The temperature was very high. Under such conditions, for the first time in the boiling soup of sea, chemicals of the non-living environment collected together and formed the first living substance called **protoplasm.** This protoplasm, in course of time, formed a membrane around itself and the first living cell appeared in the sea. The earlier cells formed organisms made of one cell only (Fig. 2.2). These organisms divided and produced new organisms. These organisms could get their food from



(a) The earth, about 5 billion years ago



(b) The earth about 2 billion years ago when life first appeared.

Fig. 2.1

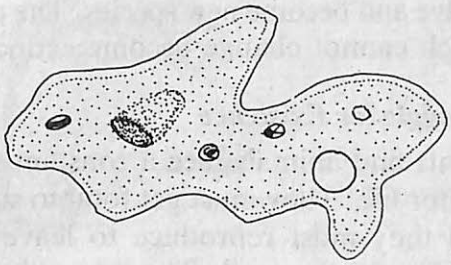


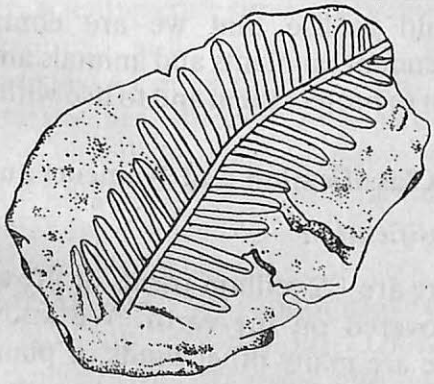
Fig. 2.2 A one-celled organism—amoeba

the surrounding mixture of chemicals from the sea. Thus life initially orginated from the non-living environment.

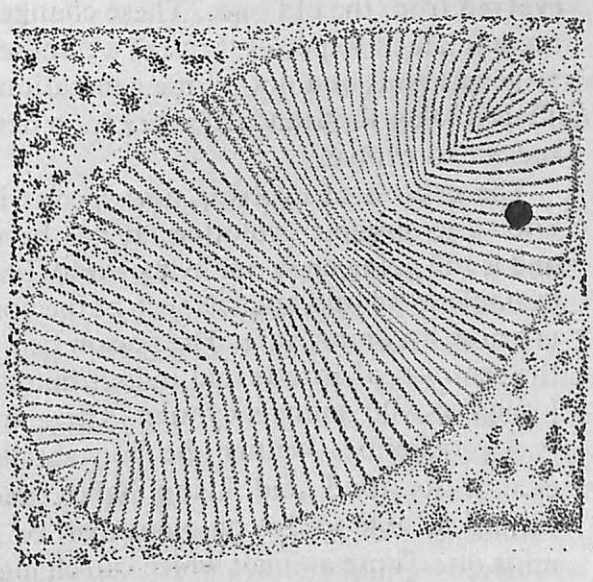
Microorganisms took their food from the sea. A time came when there was no more food for them in the sea. At that time some of the organisms developed green chlorophyll pigments and started making their own food from water, carbon dioxide and sunlight. Those cells which could not develop green pigments started eating the green cells. These cells later developed into higher animals and the green cells in turn developed into higher plants. These green cells later migrated to wet land and started growing as **algae**. Later as time passed some algae started changing and developed into bigger plants, i.e. mosses and ferns. These are plants which do not bear flowers. Unicellular animal organisms also followed them to get their food from these plants on land. This is how life started in the sea and came to land afterwards (see Fig. 2.6).

2.2 Organic Evolution

We know today that living beings that now live on the earth were not the first ones to be present on the earth. Many of the living beings that flourished millions of years back are no longer seen now. However we often find their impressions on rocks, on the sea bed, or even their preserved bodies in the layers of earth. These 'leftovers' of preserved organisms are called **fossils** (Fig. 2.3). Plants and animals no longer found on the earth are said to be **extinct.** They are now found only in the fossil form. There are, however, some plants and animals living today whose fossils are also available. Such plants and animals have not become extinct and there fossils are known as **liv-**



(a) Fossil of plants that grew 300 million years ago.



(b) Fossil of insects left on rocks.

Fig. 2.3

ing fossils. For example the giant sequoia tree is found living today and its fossils are also available. This shows that there have been and there still are changes taking place in living organisms.

We notice that plants and animals of the same kind can differ from one another. The differences in them are called **variations.** For example a healthy individual varies from an unhealthy one. A healthy person can resist diseases, survives for a longer time and can reproduce healthy children. However the unhealthy individual may soon die. Thus the healthy individual is better adapted and thus survives, while the individual with harmful variations may die. Other variations can be in colour of skin, eyesight,etc.

A species survives because of its beneficial variations. These variations are passed on to the offspring and this leads to the formation of a slightly different species than the old species of animals or plants. Thus new species are formed or **evolved** from the old ones. These changes accumulate in a species through a number of generations and not in one generation. Thus it takes thousands of years for a new species to evolve.

The process of evolving new species is known as **organic evolution.** It has been and is still going on in our living world. For example some wild animals such as the lion are now becoming rare. The reason being the removal of forests and indiscriminate killing of wild animals by man. There are two possibilities—either the lion should change its food and living habits and should be able to live on plant diet, or it must die. Those animals which can change slowly according to the new environment through a number of generations, can evolve and become new species. The others which cannot change become extinct.

Struggle for Existence

Plants and animals face a constant struggle for life. They must get food to survive and they must reproduce to leave their children on the earth. The cat is a threat to the rat, the snake is a threat to the rat and the frog. Human beings face threat from various deadly diseases and shortage of food. Hence we find that there is a constant struggle for existence. Those who lose in this struggle or competition for food, die and become extinct and those who are successful, survive and live as a new species. Dinosaurs, the giant animals (e.g. giant lizards and snakes) were once abundant on the earth, but now they are no longer present on the earth (Fig. 2.4). We only find their remains as fossils. Probably they could not get sufficient food to survive while their smaller cousins, the small lizards and snakes, survived.

How is the study of the effect of environment on evolution relevant to us? Man is forever facing the struggle for food, health, shelter, space, clothes, education, etc. To be successful we must know about our environment and how it affects us. We should realise that we are completely dependent on plants and animals and must learn to protect them and to live with them.

2.3 Classification and Nomenclature

Classification

There are 1.2 million forms of life already discovered on the earth. We know that there are many other kinds of plants and animals, which once existed on the earth but are now extinct. Only their fossils in

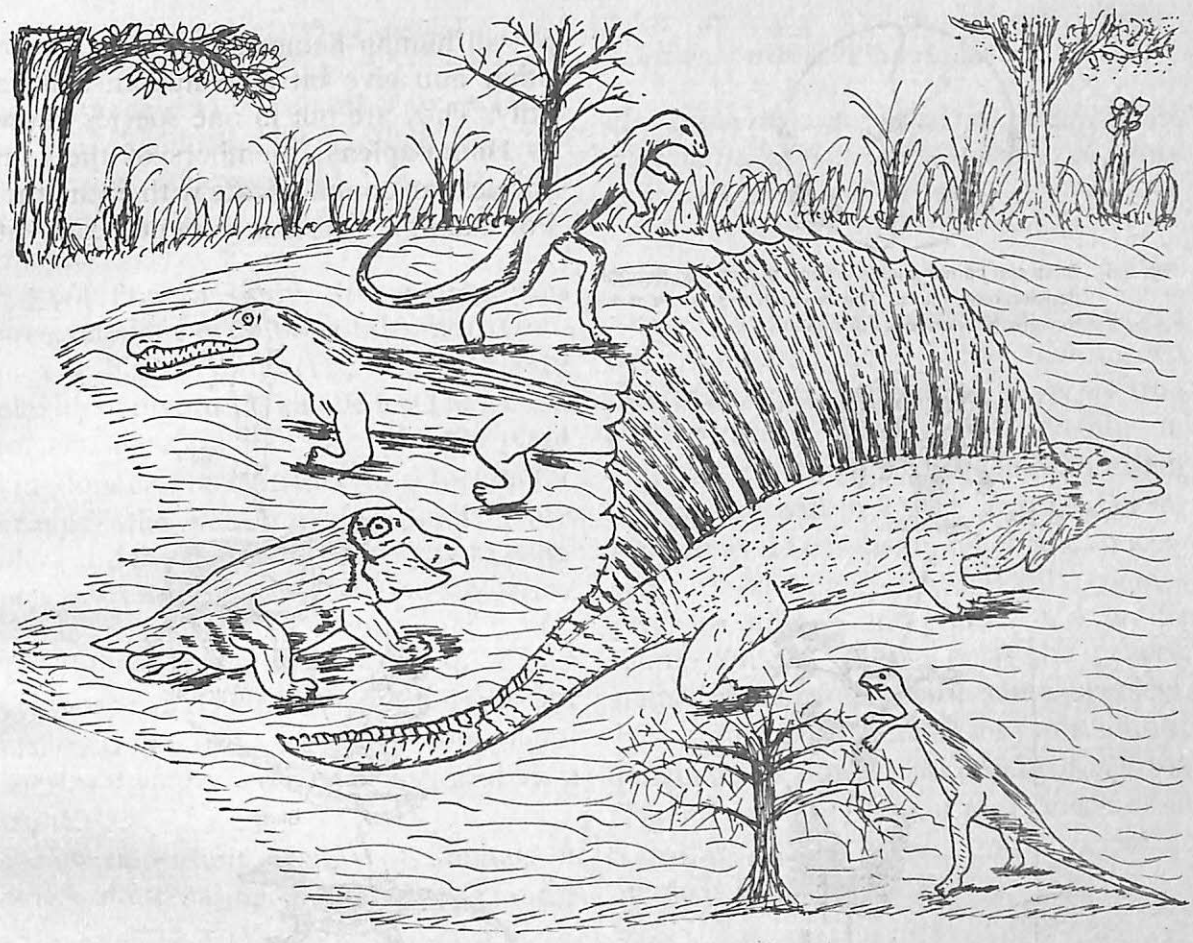


Fig. 2.4 Huge dinosaurs that once lived on the earth.

the rocks are left. If we start studying all these organisms one by one, there will be confusion and chaos. To make their study easier, scientists put similar organisms into groups, and called these groups **categories.** For example, all living organisms are divided into two main groups, called the **plant kingdom** and the **animal kingdom.** The plant kingdom consists mainly of green plants which can make their own food by the process called **photosynthesis.** They cannot move (we say they have no locomotion). The animal kingdom consists of mostly non-green living beings which obtain their food from other animals and plants. These major groups are further classified into smaller groups.

In addition to these two major groups there are very small microscopic organisms (organisms which cannot be seen with naked eyes because of their very small size, but can be seen only with the help of a powerful lens or a microscope) such as bacteria and viruses. These are known as **microorganisms.** Some microorganisms enter our body and cause diseases.

A group of individuals who resemble one another and reproduce young ones of their own kind is known as a **species.** For exam-

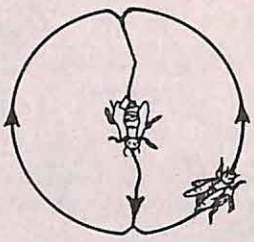


Fig. 2.5 Bees can communicate among themselves through dancing movements. The direction and nature of the movements conveys information.

ple all human beings are similar to each other and give birth to human children only. They are put in one species known as **Homosapiens.** Members of the same species can communicate with each other. For example bees can communicate with

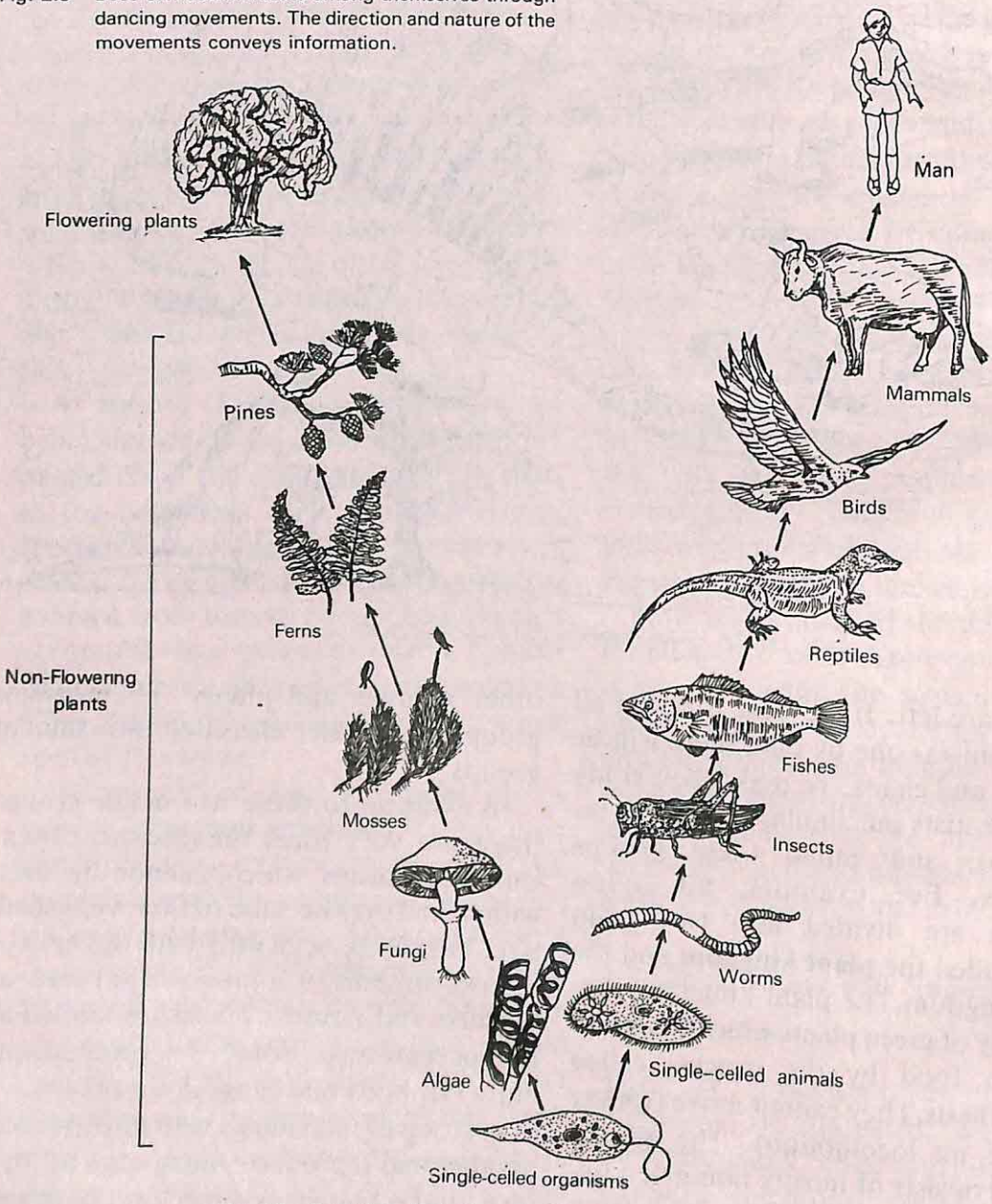


Fig. 2.6 Evolution of plants and animals from single-celled organisms.

each other with the help of special type of dancing movement (Fig. 2.5). Ants can communicate with each other by secreting certain chemicals which other ants can smell and follow. Dogs can also communicate with each other in a similar manner.

Evolution of simple living organisms preceeded the evolution of the more complex or 'higher' forms (Fig. 2.6). The complexity of organisms can be used as a basis for classification. For example, the plant kingdom can be classified into two major groups—the **non-flowering plants** (simpler) and the **flowering plants** (more complex). The important non-flowering plants are ferns, mosses, fungi, algae, etc. The flowering plants can be classified into gymnosperms (plants where seeds are not enclosed in a fruit, e.g., pine) and angiosperms (where seeds are enclosed in a fruit).

The important groups of animals in order of increasing complexity are unicellular animals, worms, insects, fishes, reptiles, birds and mammals.

Grouping the organisms that resemble and the naming of these groups and organisms, is known as **classification.**

Nomenclature

As there are so many species in this world we must name them. While naming we face the language problem. A *peepal* tree is known as *aswatha* in Bengali, in Gujarati it is known as *jari,* in Malayalam as *aryalum* and in Tamil as *aras*. Therefore, to avoid confusion it becomes necessary to have uniform scientific names given to animals and plants. A scientific name consists of two parts: the **generic** name (genus) and **specific** name (species). For example the peepal tree in scientific language is known as *Ficus religiosa.* Tiger is *sher* in Hindustani, *vyaghra* in sanskrit, *puli* in Telugu, and its scientific name is *Panthera tigris.*

EXERCISES

1. What did the earth look like five billion years ago? _____

_____

_____

_____

2. How did the first sea form on the earth? _____

_____

_____

3. (i) From where did the first organisms on the earth get their food?

(ii) What happened when this food was exhausted?

4. (i) What are fossils?

(ii) What are living fossils?

5. How do new species evolve from old ones?

6. Why have dinosaurs become extinct?

7. (i) Why is classification of plants and animals necessary?

(ii) Why are scientific names given to plants and animals? _____

8. Write the scientific names of the following:

Lion: Peepal tree: Man: _____

9. Fill in the blanks:

(i) The first living cell appeared in the _____.

(ii) Life originated on the earth nearly _____ years ago.

(iii) The differences among individuals of any species are known as _____

(iv) All green living organisms which have no locomotion and can prepare their own food are grouped into the _____ _____.

(v) _____ are small organisms which can be seen only under a microscope.

(vi) A group of individuals that resemble one another and reproduce young ones of their own kind is known as a _____.

(vii) Putting the organisms that resemble each other in groups is known as _____.

10. Write true or false.

(i) Life originated on the earth at some remote time in the past.

(ii) Oxygen was present in the atmosphere two billion years ago when life originated.

(iii) Today life can originate even from non-living chemicals.

(iv) Life came to earth from some other planet.

(v) Variations among individuals of any species are essential for adaptation according to the changing environment.

(vi) Members of different species can communicate with each other.

3

Microscopic Structure of Living Things

3.1 Microscope

A microscope (Fig. 3.1) is an instrument which can magnify objects hundreds of times. It contains several magnifying glasses or lenses. With the help of the microscope we can see the cells of plants and animals.

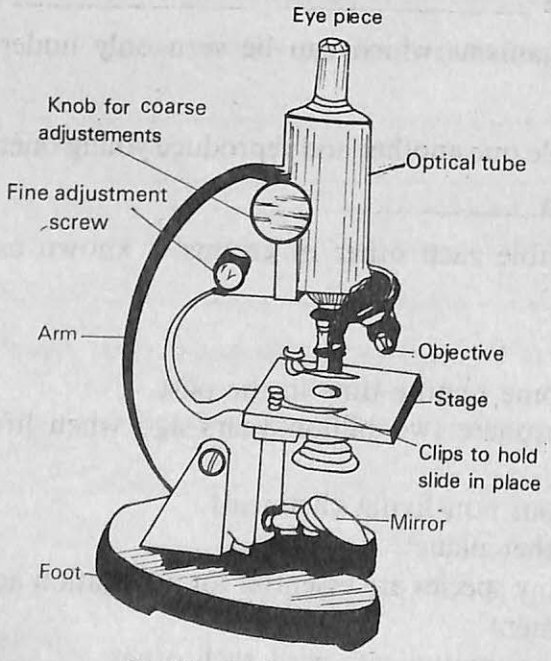
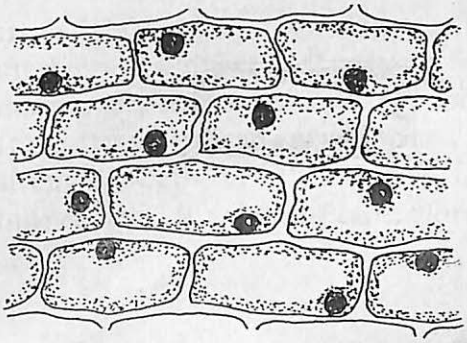


Fig. 3.1 A microscope.

The microscope is **simple** or **compound** depending on the number of lenses it has. Simple microscopes are double convex lenses. A magnifying glass is a simple microscope. A compound microscope consists of a combination of lenses. A set of lenses, the **objective lenses,** near the object are arranged to act as a single lens. The **eye piece** consisting of a single lens, is located at the top of the **optical** tube.

The object to be viewed is placed on a glass-slide. The slide is placed on the opening in the platform known as **stage**, and is held in position by a pair of clips. Light is focussed on to the material, through the opening by adjusting the mirror. The object is viewed through the eye piece after adjusting the **coarse** or **fine** adjustment screws.



(a) Cells are the building blocks of bodies of living beings.

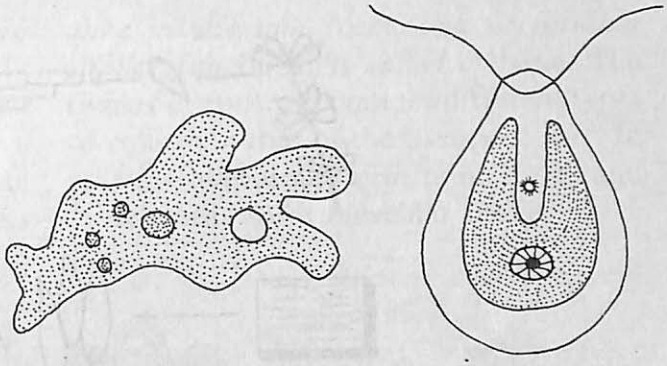


Fig. 3.2 (b) Single-celled organisms.

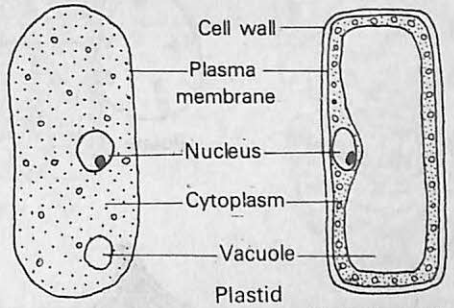
3.2 The Cell

If you look at a newspaper picture through a strong magnifying glass you can see a mass of tiny black dots. All these dots combine to form an object you can recognize. Each dot is a unit of the picture. Each is a small part of a bigger whole.

Similarly, if you magnify any part of a plant or animal with the help of a microscope you can see that they are also made up of small living units (Fig. 3.2a). These living units are called **cells.** A cell is a microscopic mass of living substance called **protoplasm**. Some plants and animals such as **chlamydomonas** and **amoeba** actually consist of one cell only (Fig. 3.2b). They are known as **unicellular** plants and animals. Bigger plants and animals such as ferns, mosses, flowering plants, man, dog, etc., are formed of millions of cells, all working together and cooperating with each other. These are called **multicellular** plants and animals.

The protoplasm of a cell is a colourless, transparent jelly-like substance. It is present only in living cells and not in dead cells.

The protoplasm is divided into two portions. The central denser, spherical portion is dark and is known as the **nucleus**. The outer thinner and lighter portion is called the **cytoplasm.** In the cytoplasm of plant cells there are small bodies called **plastids** which contain green pigments called **chlorophyll.** It is because of them that the plants are green. The protoplasm is surrounded by a thin membrane called **plasma membrane**. In plants the cell is enclosed in a **cell wall.**



(a) An animal cell (b) A plant cell.

Fig. 3.3

There are cavities called **vacuoles,** of different sizes, present in the cytoplasm, filled with a fluid called **cell sap.**

Activity 1: Take a leaf of hydrilla and put it on a glass slide. Add a drop of water and put a thin cover glass on top of it. Observe it under a microscope.

Draw diagrams of what you can see.

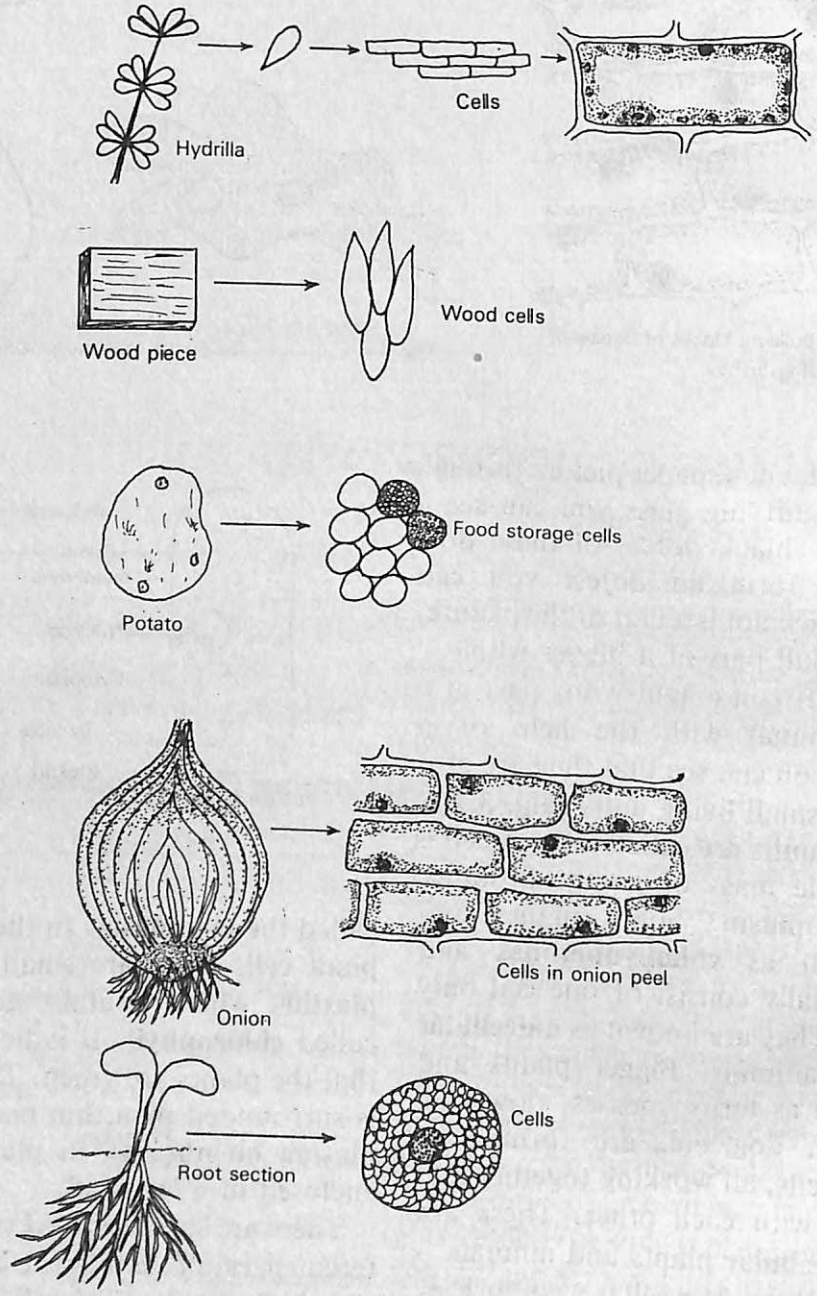


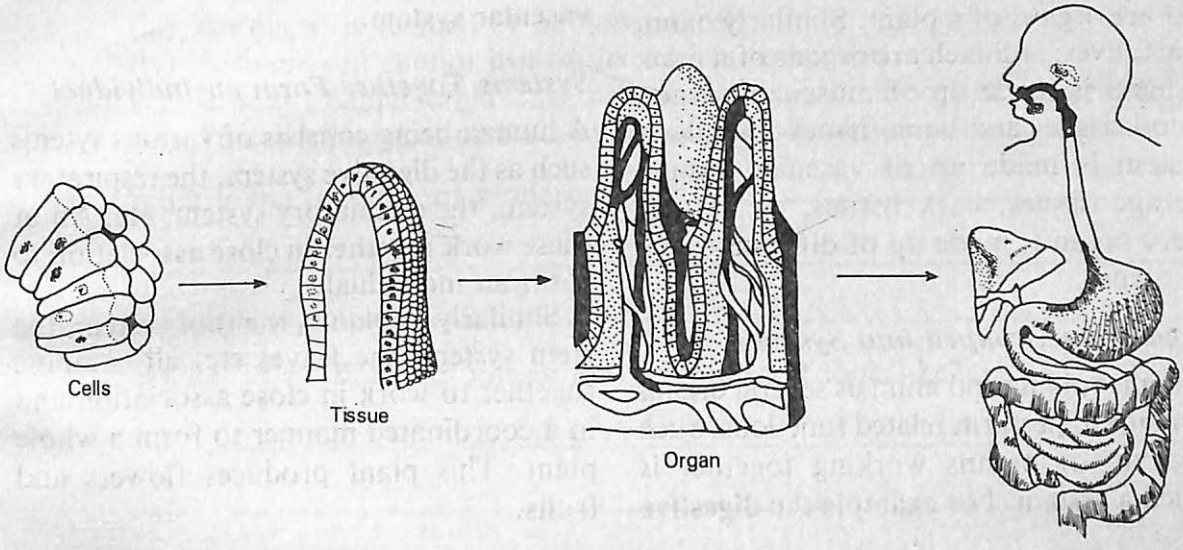
Fig. 3.4 Types of cells.

3.3 From Cells to Individuals

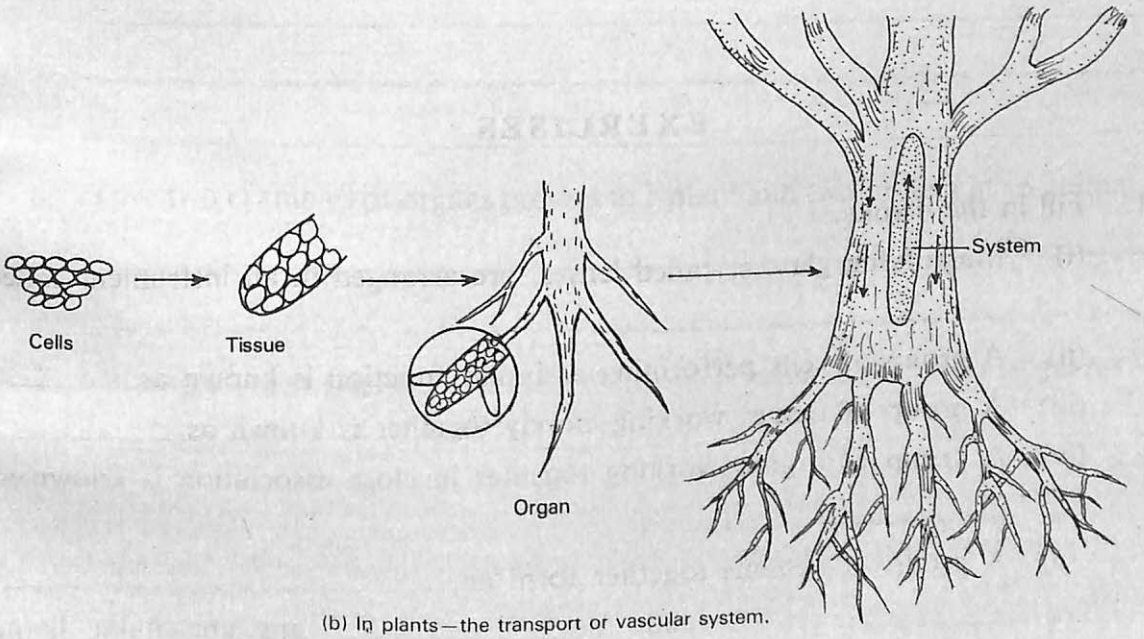
Tissue

Multicellular plants and animals are made up of various types of cells. Each kind of cell is highly developed for a particular kind of life activity. For example cells of roots are specialised for absorption of water

from the soil. The stem cells give mechanical support to the plants. Similarly in animals, the blood cells are specialised for carrying oxygen, while bone cells give strength. Cells of the muscles facilitate movements. *A group of cells more or less alike in size and form, and performing similar functions, is called a* **tissue.** The tissues of root will contain different types of cells than that of the tissues of leaf. In animals bone cells form bone tissue and muscle cells form muscular tissue.



(a) In man—the digestive system.



(b) In plants—the transport or vascular system.

Fig. 3.5 The organisation of a system.

Tissues are Grouped to Form Organs

In plants and animals even a highly specialised tissue cannot perform a life activity, all by itself. This requires a group of tissues working together closely. This complex part formed of tissues is known as an **organ**. For example, root, stem and leaf are organs of a plant. Similarly hand, heart, liver, stomach are organs of a man. A hand is made up of muscular tissues, blood tissues and bone tissues . Similarly a stem is made up of vascular tissues, storage tissues, bark tissues, etc. Hence every organ is made up of different types of tissues.

Organs are Grouped into Systems

In higher plants and animals several organs combine to perform related functions. Such a group of organs working together is called a **system.** For example the **digestive system** of man performs functions related to the digestion of food. It is composed of many organs such as stomach, liver, and intestines. In plants different channels present in the root, stem and leaf for carrying water from the root to the leaf, and food from the leaf to the root form a **vascular system.**

Systems Together Form an Individual

A human being consists of various sytems such as the digestive system, the respiratory system, the circulatory system, etc. All of these work together in close association to form an individual.

Similarly in plants, the root system, the stem system, the leaves, etc., all combine together to work in close association and in a coordinated manner to form a whole plant. This plant produces flowers and fruits.

EXERCISES

1. Fill in the blanks.

   (i) Magnifying glasses, called lenses, are arranged in an instrument called _____ .

   (ii) A group of cells performing a similar function is known as_____ .

   (iii) A group of tissues working closely together is known as _____ .

   (iv) A group of organs working together in close association is known as _____ .

   (v) A group of systems together form an _____ .

   (vi) _____ and _____ are unicellular living beings.

(vii) The protoplasm is divided into _____ and _____

(viii) A plant cell is surrounded by a _____ which is not present in an animal cell.

2. Write true or false.
   (i) Tissues of root are different from the tissues of leaf.
   (ii) Protoplasm is present in a dead cell.
   (iii) An organ is formed of millions of cells.
   (iv) A single cell cannot live on its own independently.
   (v) In multicellular organisms, cells live in coordination with other cells.
   (vi) To see a material under a microscope it should be properly lighted.

3. What is the function of a microscope? _____

4. Where do we find protoplasm and what does it look like? _____

5. Mention the living and non-living parts of a plant cell. _____

6. Give two examples of organs present in a plant and two present in an animal. _____

7. Why are green pigments (chlorophyll) not present in the roots of plants? _____

4

Structure and Function in Plants

You can observe many types of plants around you. Some are small, while others are big. Some can be grown in pots such as chrysanthemum, flox, chillies, etc. Some such as jasmine, henna or bougainvillea are grown as hedges, and some others are large trees for e.g., peepal, neem, mango, gulmohur, etc. Small tender plants are called **herbs**. Strong, woody and bushy plants such as rose and bougainvillea are called **shrubs.** Plants having a strong thick main pillar-like stem and strong branches are called **trees.** All these plants bear flowers. They are called **flowering plants** (Fig.4.1a).

Besides flowering plants there are other types of plants called **non-flowering plants,** such as ferns and mosses. These plants never bear flowers (Fig. 4.1b).

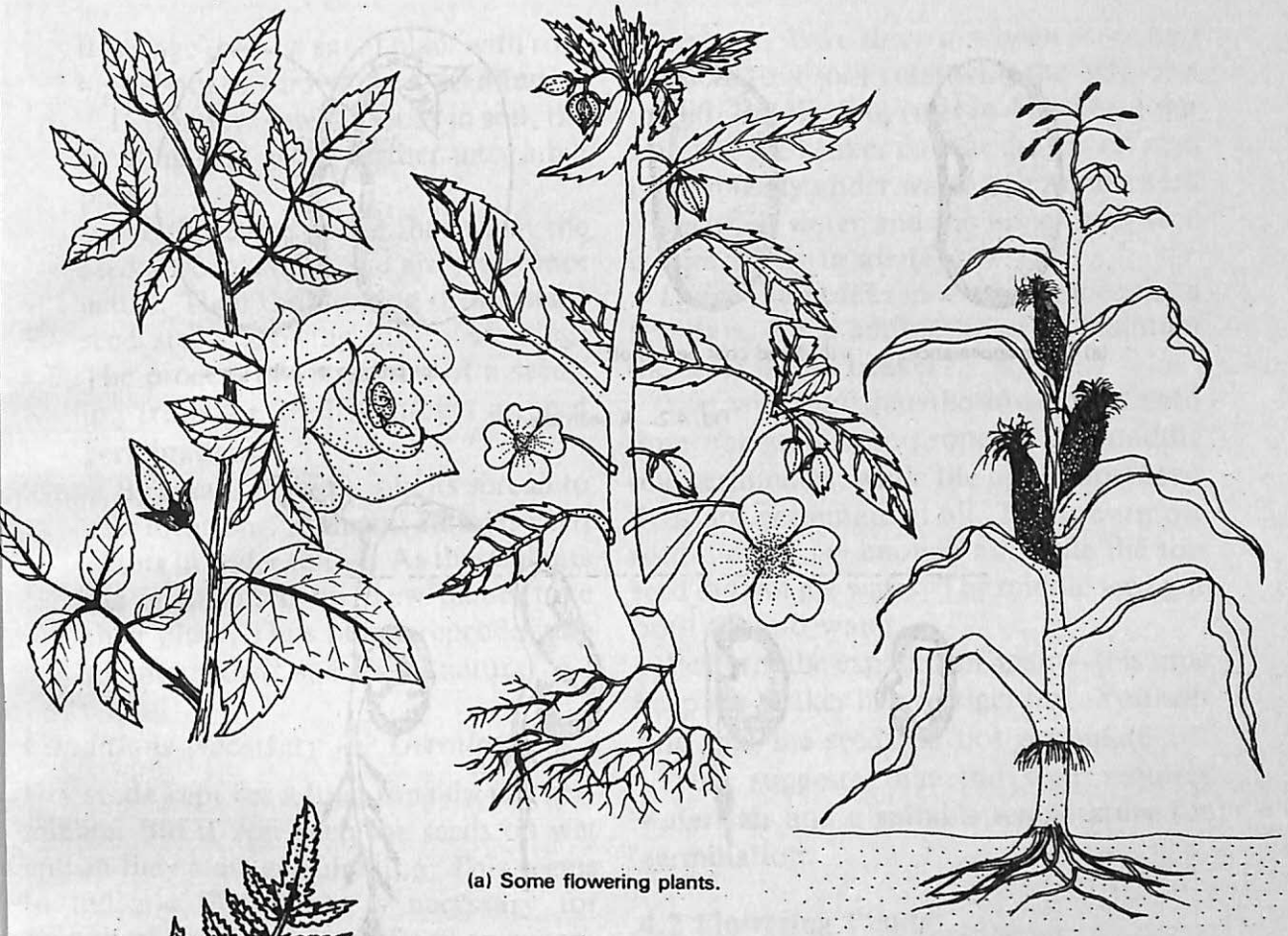
When a flower of a flowering plant withers, it produces fruits. Fruits bear seeds. Seeds grow into new plants.

Activity 1: Collect seeds of fruits and vegetables you eat at home. Pack them in small polythene bags. Display them on a chart paper or in a carbon box.

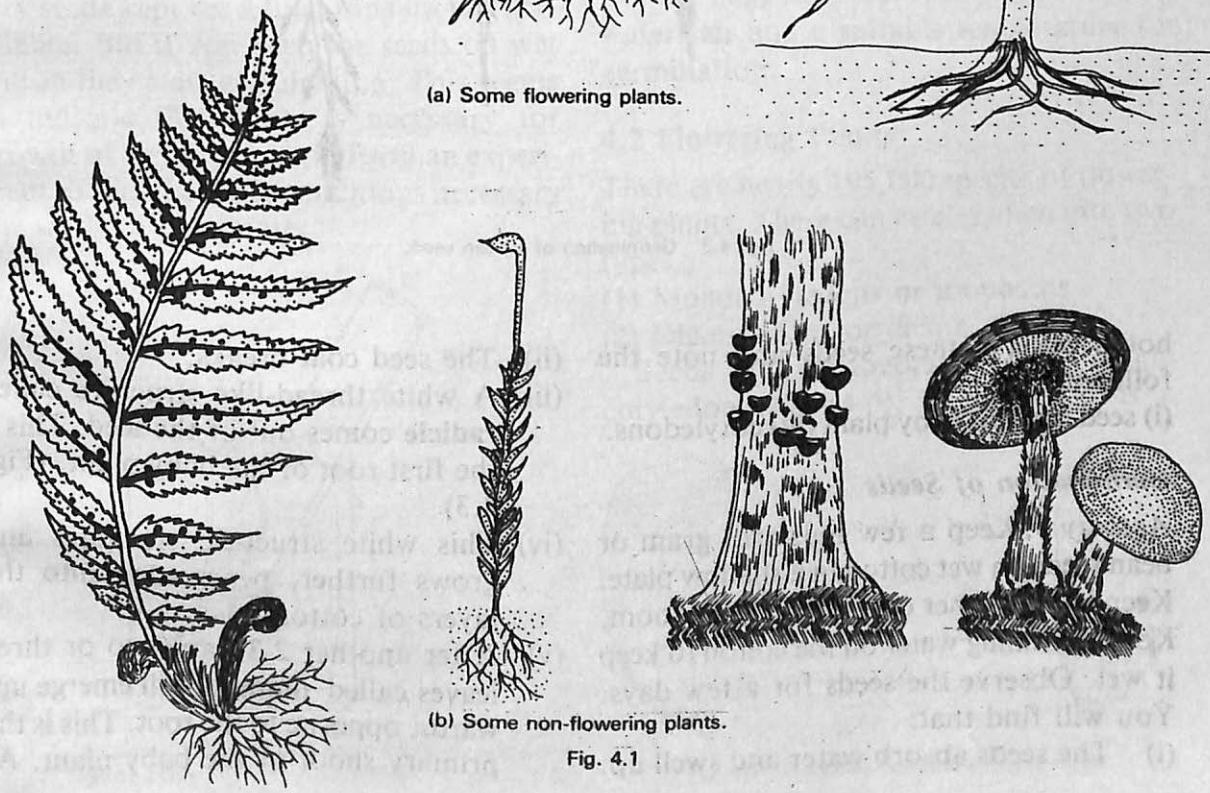
4.1 The Seed

A seed (Fig. 4.2) contains a small baby plant within it. This baby plant is called an **embryo.** The seed also stores food in one or two fleshy leaves called **cotyledons** which also surround and protect the embryo. This food is utilized by the small plant when it begins to grow, till it is big enough to have its own roots and green leaves. The embryo has a small baby root or **radicle** and a baby shoot or **plumule.** A seed is covered by a protective covering called a **seed coat.**

Activity 2: Soak bean or gram seeds in water for 24 hours. Tie up these seeds loosely in cloth and keep them in a corner of the verandah. After another 24 to 40

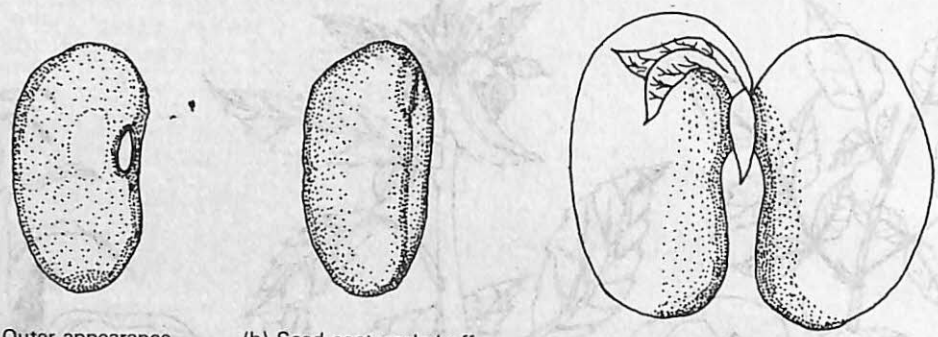


(a) Some flowering plants.



(b) Some non-flowering plants.

Fig. 4.1



(a) Outer appearance. (b) Seed coat peeled off. (c) Embryo or baby plant.

Fig. 4.2. A bean seed.

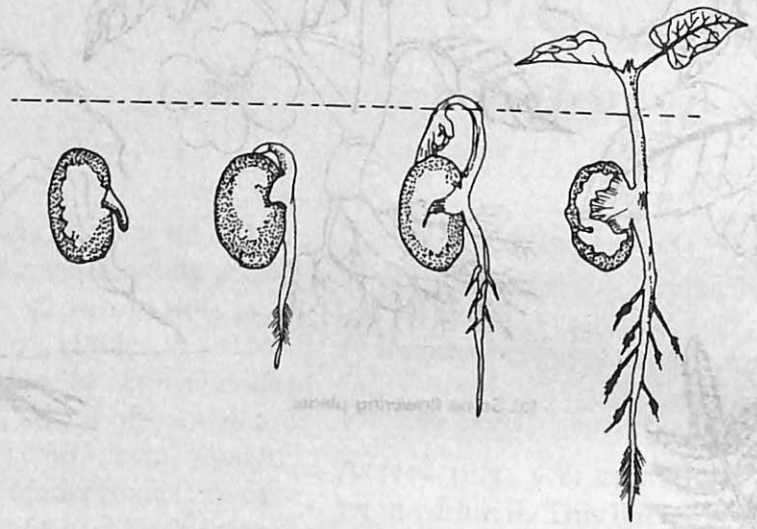


Fig. 4.3 Germination of a bean seed.

hours observe these seeds and note the following:

(i) seed coat (ii) baby plant (iii) cotyledons.

Germination of Seeds

Activity 3: Keep a few mustard, gram or bean seeds on wet cotton in a shallow plate. Keep it in a corner on any shelf in a room. Keep sprinkling water on the cotton to keep it wet. Observe the seeds for a few days. You will find that:

(i) The seeds absorb water and swell up.

(ii) The seed coat breaks.

(iii) A white thread-like structure called **radicle** comes out of the seed. This is the first root of the baby plant, (Fig. 4.3).

(iv) This white structure elongates and grows further, penetrating into the layers of cotton.

(v) After another 2-3 days two or three leaves called **plumule** will emerge upwards, opposite to the root. This is the primary shoot of the baby plant. At

this stage the new small plant with root and shoot is known as a **seedling.**

If you now sow the seeds in soil, the seedling will grow further into a big plant.

We therefore notice that when the seed absorbs water and air it becomes active. Then the sleeping or **dormant** seed starts growing into a seedling. The process of formation of a seedling from the seed is known as **seed germination.**

By means of seeds, plants spread to new locations. Man and animals need plants in order to live. As these plants die or are used up, new plants take their place. Thus plants reproduce to maintain their species in nature.

Conditions Necessary for Germination.

Dry seeds kept for a long time do not germinate. But if you keep the seeds on wet cotton they start germinating. This seems to indicate that water is necessary for growth of seeds. Let us perform an experiment to find the other conditions necessary for seeds to germinate.

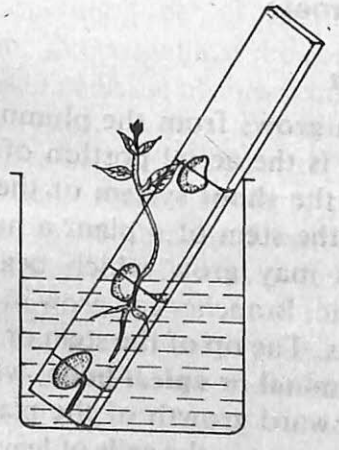


Fig. 4.4 Experiment to demonstrate conditions necessary for germination.

Activity 4: Take three dry bean seeds and tie them to a foot ruler with the help of a thread. Put the foot ruler in a beaker. Pour water in the beaker so that the lowest seed is completely under water, the middle seed is partly in water and the uppermost seed is completely in air (Fig. 4.4).

Leave the beaker in a warm place for a few days. Keep adding water to maintain the level in the beaker.

You will find that the lowermost seed does not germinate properly, the middle one germinates, while the uppermost seed does not germinate at all. The lowermost seed did not get enough air while the top seed did not get water. The middle seed got both air and water.

Perform the experiment again—this time keep the beaker in a refrigerator. You will find that the seeds do not germinate.

This suggests that the seed requires **water, air** and a **suitable temperature** for germination.

4.2 Flowering Plants

There are nearly 195,000 species of flowering plants. These can be classified into two types.

(1) Monocotyledons or monocots

(2) Dicotyledons or dicots

Seeds of monocots have a single cotyledon (Fig. 4.5). A cotyledon is a

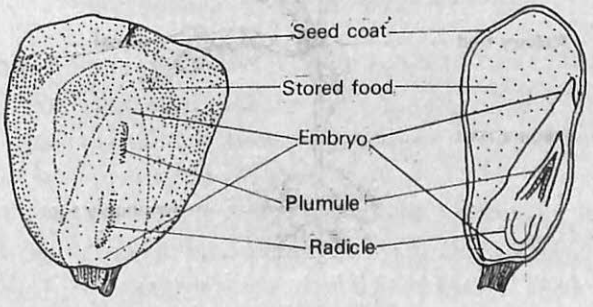


Fig. 4.5 A monocotyledonous seed—maize.

special kind of leaf which develops in the seed. It absorbs, stores, and digests food. It supplies this food to the young plant after the seed has sprouted and until it starts manufacturing its own food. Dicotyledons have two such leaves (Fig. 4.2). Other organs of dicots and monocots such as roots, stems, leaves and flowers also differ from each other.

4.3 Parts of a Flowering Plant

A plant (Fig. 4.6) has two types of parts or organs—**vegetative** and **reproductive**. The vegetative organs are the root, the stem and the leaves. They perform all activities of life except reproduction. The flower is the reproductive organ of the plant. It produces the seed.

The Root

The part of the plant which anchors it to the soil is called the root. It develops from the radicle of the embryo and as the plant grows it spreads through the soil. The main or **primary root** is thick and large. It bears branches known as **secondary roots** which spread out in the soil in all directions.

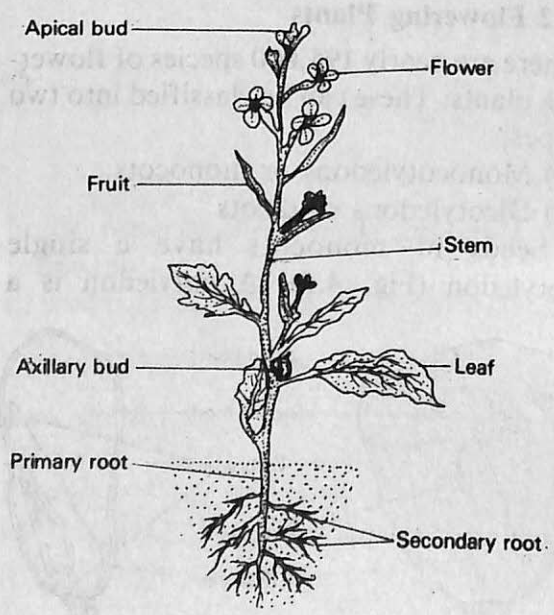


Fig. 4.6 Parts of a plant.

Functions of the Root

(1) It anchors the plant firmly in the ground.

(2) It absorbs water and minerals (salts) through root hairs from the soil.

(3) It conducts this water and salts to the leaves through the stem and branches. Water and minerals are necessary for the plant to carry on the activities of life.

Modification of the Roots (Fig. 4.7)
In some plants, roots get modified to carry on special functions such as storage of food.

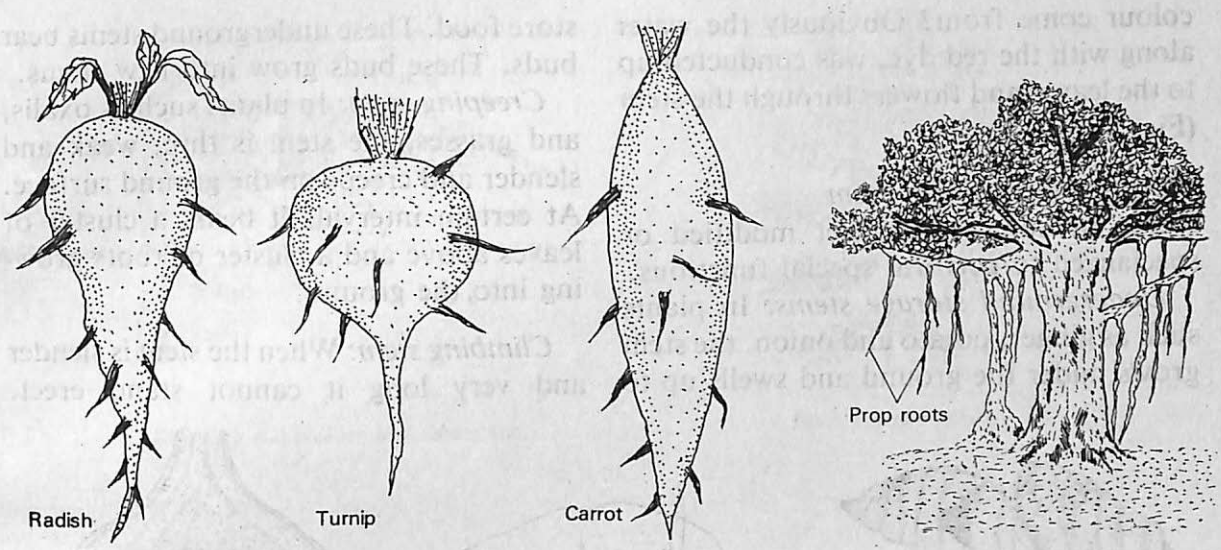
In turnip, carrot, radish, etc., the roots, instead of spreading in the ground, start swelling up. They store some of the surplus food. These are called **tuberous roots.**

In a banyan tree, a number of roots are produced from the branches. These roots grow downwards and enter the ground. These act as pillars to support the big horizontal branches of the tree and are called **prop roots.**

The Stem

The stem grows from the plumule of the seed and is the aerial portion of a plant. It forms the **shoot system** of the plant.

From the stem of a plant a number of branches may grow which bear leaves, flowers, etc. Branches can grow in different directions. The tip of the stem or a branch bears **terminal** or **apical buds**, which help in the upward growth of the plant. Buds are also present in the **axils** of leaves. These are called **axillary buds.**



(a) Some roots store food.

(b) Prop roots of banyan.

Fig. 4.7 Modifications of root.

When the stem is green and tender it is called a **herbaceous** stem. When it is hard and woody it is called a **woody** stem. Bushes and trees have woody stems. Herbs have herbaceous stems.

Functions of the Stem

(1) The stem is the supply line, a link between the roots and leaves. There are long conducting tubes or channels inside the stem. These channels are formed of special cells. The tissue of these channels is known as **xylem**. Xylem conducts water and minerals from the root to the leaves.

There is another set of channels in the stem called **phloem**. Food from the leaves is conducted to roots, growing parts of the plant, and fruits through the pholem. Thus **conduction** of water, minerals and food is the main activity of the stem.

(2) The stem bears leaves and flowers on its branches. It supports their weight and displays them in such a way that they receive sufficient sunlight for their activities.

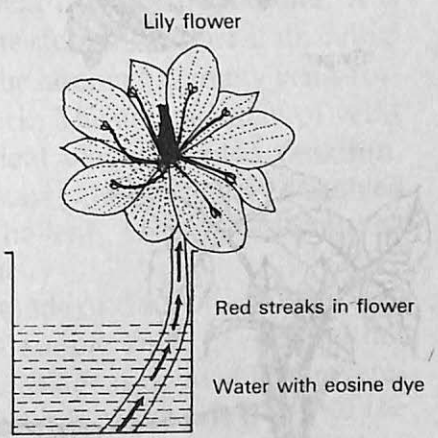


Fig. 4.8 Conduction through the stem.

Activity 5: To observe conduction through the stem take a coleus twig or a white lily flower with a short stalk. Dip it in water coloured with eosine dye (If this is not available red ink will do.) Observe it after one hour. What do you notice?

You will be able to see red streaks in the lily flower/coleus leaves. Where did the red

colour come from? Obviously the water along with the red dye, was conducted up to the leaves and flowers through the stem (Fig. 4.8).

Modifications of the Stem

Stems of some plants get modified or specialized to perform special functions.

Underground storage stems: In plants such as ginger, potato and onion, the stem grows under the ground and swells up to store food. These underground stems bear buds. These buds grow into new stems.

Creeping stem: In plants such as oxalis, and grasses, the stem is thin, weak and slender and creeps on the ground surface. At certain intervals it bears a cluster of leaves above and a cluster of roots growing into the ground.

Climbing stem: When the stem is slender and very long it cannot stand erect.

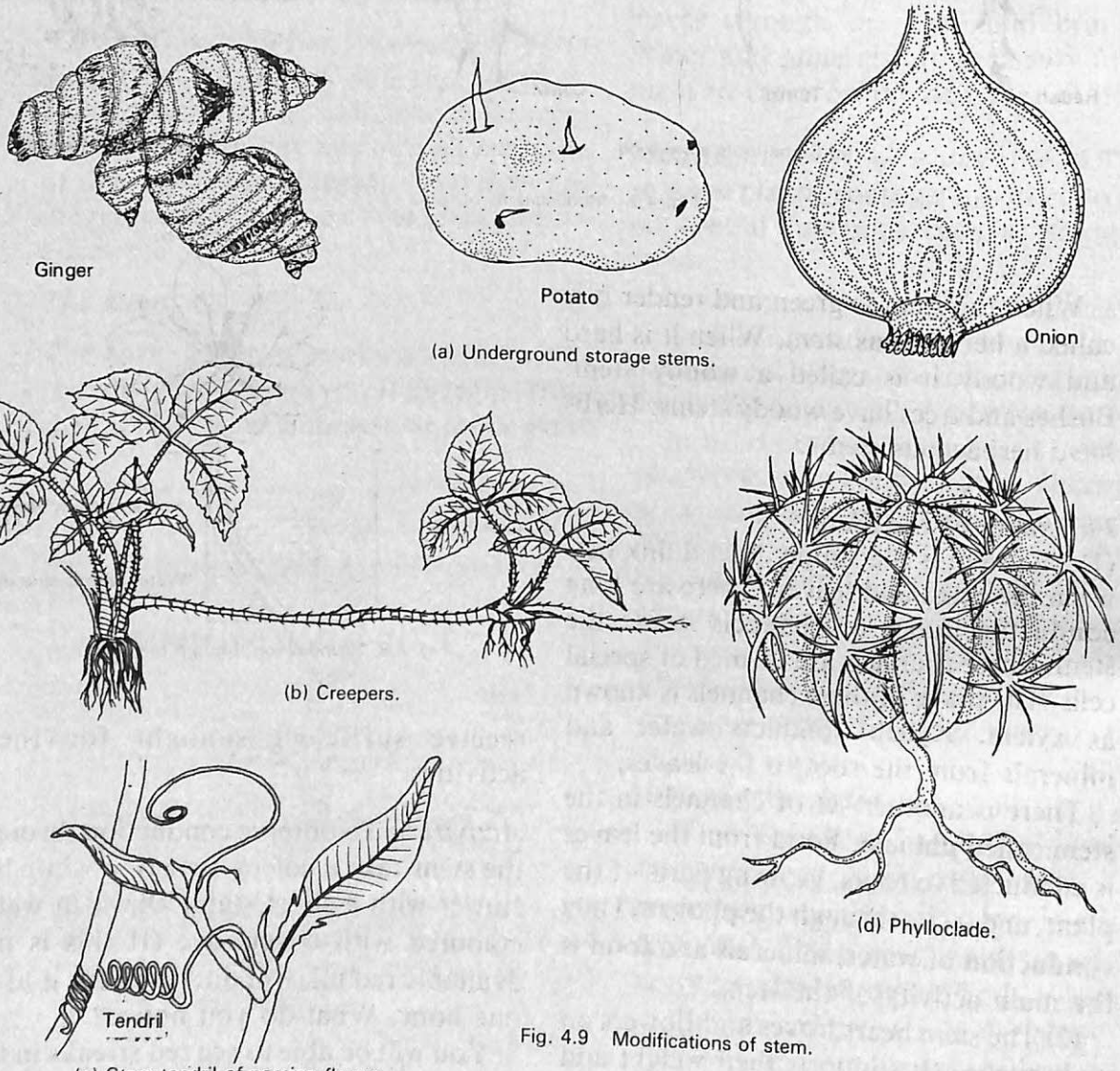
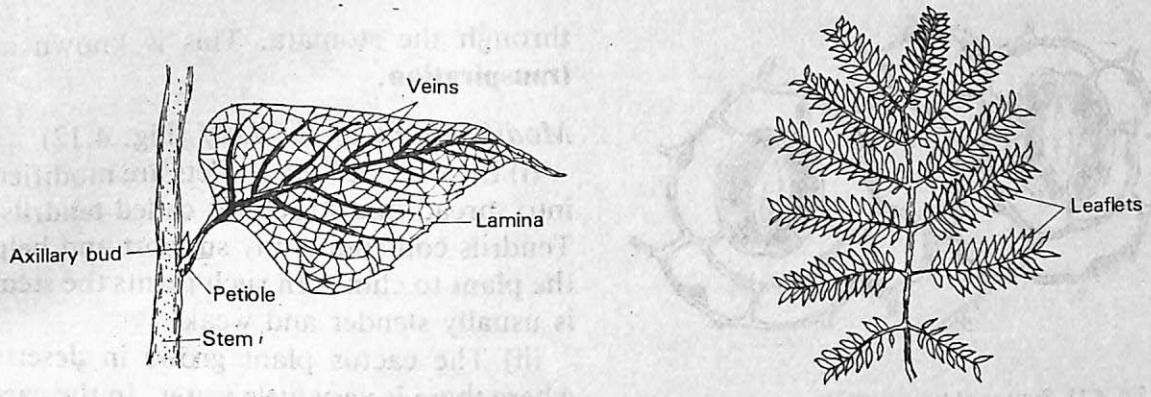


Fig. 4.9 Modifications of stem.



(a) Structure and position of a simple leaf.

(b) A compound leaf.

Fig. 4.10

However the stem must climb up to expose its leaves to sunlight (Why?) Such plants climb up in two ways.

(i) By twining around any object, as in bougainvillea.

(ii) The stem produces thread-like structures called **tendrils**. These tendrils coil around any support and hold the whole plant upright to expose its leaves and flowers to sunlight.

Examples are passion flower and cucumber.

Phylloclade: In cactus the stem becomes thick, fleshy and green. It takes over the functions of the leaf. The leaves are modified into thin needle-like structures called spines. They protect the plant from enemies. Such stems are known as **phylloclades.**

The Leaf

A leaf (Fig. 4.10a) is a flattened green organ of a plant and always arises on the stem. Leaves are of many shapes and sizes. They have different arrangements on the stem. The angle between the stem and leaf is known as **axil** and the bud present there is known as **axillary bud.** The flat green portion of a leaf is called the **lamina**. It is attached to the stem by a short stalk called the **petiole**. The lamina has many veins forming a network. The arrangement of veins through the leaf blade is called **venation.** The veins carry water and dissolved minerals to the leaf. They also strengthen the leaf blade.

When the blade of the leaf is in one piece it is called a **simple leaf**. In many other leaves the leaf blade is divided into several parts. Each part is called a **leaflet** and the whole leaf is known as a **compound leaf** (Fig 4.10b), like the leaf of garden pea.

Leaves fall off after a few seasons or a few years. In some trees all leaves fall off during the autumn season and the trees become bare. New leaves then appear. In other trees leaves keep on falling in small numbers and the tree remains evergreen.

Functions of the Leaf

(i) Green leaves can prepare food for the plant from water and carbon dioxide, with

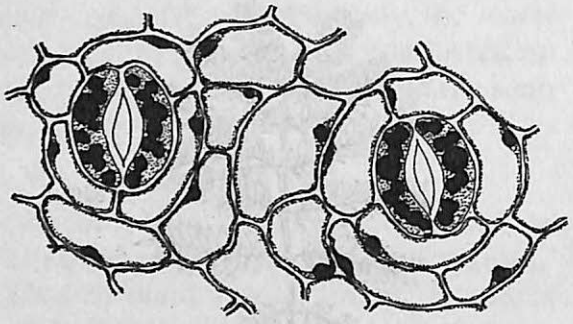


Fig. 4.11 Surface of leaf modified to show stomata.

the help of chlorophyll pigments, and solar energy from the sun. This process of making food is known as **photosynthesis.**

(ii) There are tiny pores called **stomata** on the surface of leaves (Fig. 4.11). Through these pores, plants absorb oxygen and give out carbon dioxide. Thus leaves are **respiratory** organs as well.

(iii) Extra amount of water in the plant evaporates in the form of water vapours through the stomata. This is known as **transpiration.**

Modifications of the Leaf (Fig. 4.12)

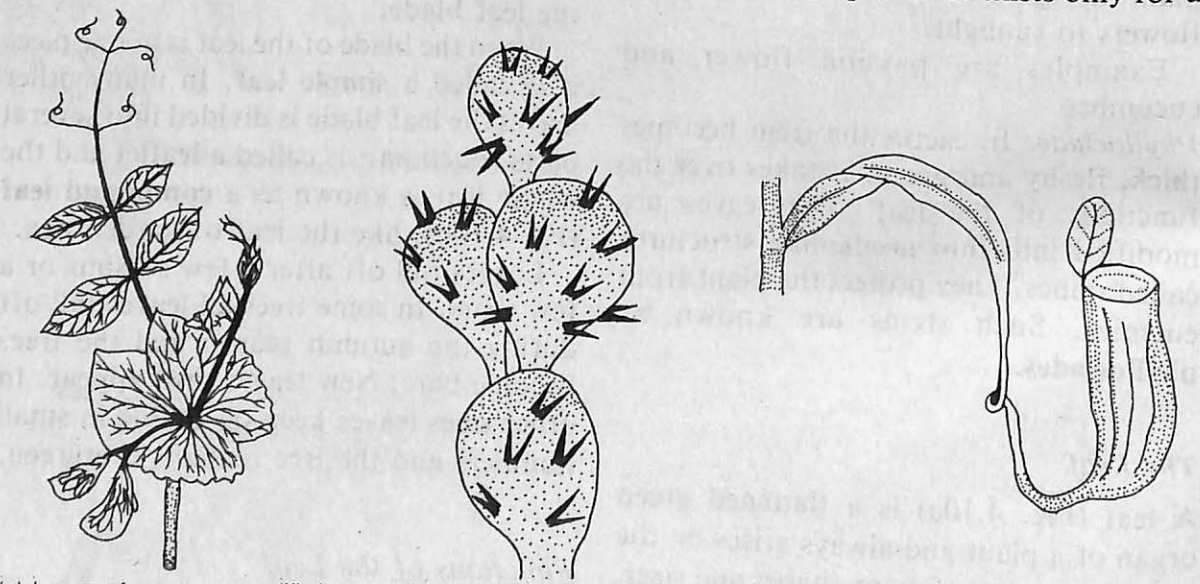
(i) In sweet pea the leaflets are modified into thread-like structures called **tendrils.** Tendrils coil round any support and help the plant to climb. In such plants the stem is usually slender and weak.

(ii) The cactus plant grows in deserts where there is very little water. In the cactus the leaves are modified into spines to reduce loss of water from the surfaces of leaves by transpiration. The spines also protect the plant.

(iii) In the pitcher plant the leaves are modified into tubular vase-like structure with a lid to trap insects. These plants are called insectivorous plants. They 'eat' and digest the insects.

4.4 Reproduction in Plants

A flower is a specialized organ which reproduces the species. It exists only for a

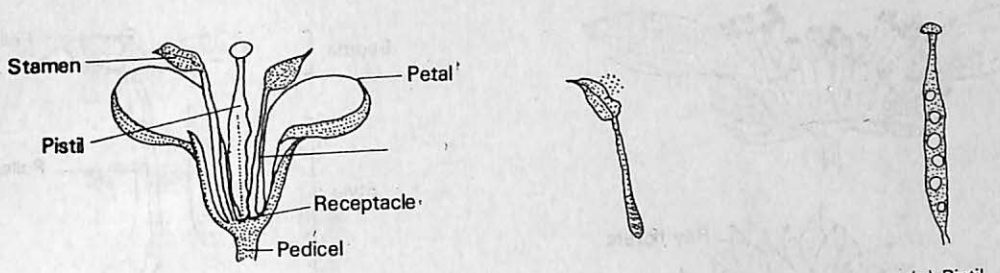


(a) Leaves of sweet pea modified into tendrils for climbing.

(b) Leaves of cactus modified to form spines.

(c) Leaves of pitcher plant modified for trapping insects.

Fig. 4.12 Modification of the leaf.



(a) Vertical section. (b) Stamen. (c) Pistil.

Fig. 4.13 Parts of a flower.

short time, and then some parts of it develop into the fruit, while the other parts wither away. The fruit contains the seeds, which in turn produce a new generation of plants.

Non-flowering plants such as ferns, mosses, mushrooms, molds, algae, etc. do not bear seeds. In place of seeds these plants produce **spores,** from which new plants grow. Spores are very small. Thousands of them together look like a little speck of dust.

The Flower (Fig. 4.13)

A typical flower such as that of petunia, mustard, china rose or rose, has four sets of parts. These four parts are present on the tip of a stalk called **peduncle** or **pedicel.** The tip is known as the **receptacle.** The outermost ring of green leaf-like structures of the flower is called **calyx**. The leaf-like **sepals** protect the flower during the bud stage. Inside the calyx there is a whorl known as **corolla.** It contains coloured leaf-like structures called **petals.** They make the flowers attractive. Towards the inner side of the petals there are a few **stamens.** Each stamen consists of a stalk called **filament** and a knob-like structure at the top called **anther.** The anther produces a mass of yellow grains called **pollen grains.** These play an important part in reproduction.

Right in the centre of the flower there is a **pistil.** It consists of a swollen base called the **ovary**. The ovary continues into a long **style** and ends into a sticky knob called **stigma.** Inside the ovary there are **ovules** which later develop into seeds. There can be many ovules in one ovary.

Types of Flowers

Flowers which consist of all the four whorls—calyx, corolla, stamens and pistil are called **complete flowers,** e.g., the china rose. If one or more parts are missing it is known as an **incomplete flower,** e.g., the mulberry flower. In one type of mulberry flower, the pistil is missing while in another type, the stamens are missing.

Composite Flower

Sunflower, daisy, zinnia, etc., are not single flowers. Each one is a cluster of many small flowers (Fig. 4.14). The flower cluster is divided into two kinds. The outer strap-shaped flowers **(florets)** are called **ray** florets and the central ones, **disc** florets.

Reproduction in flowering Plants

When the pollen in the anther is ripe, the pollen grains are exposed to wind, water

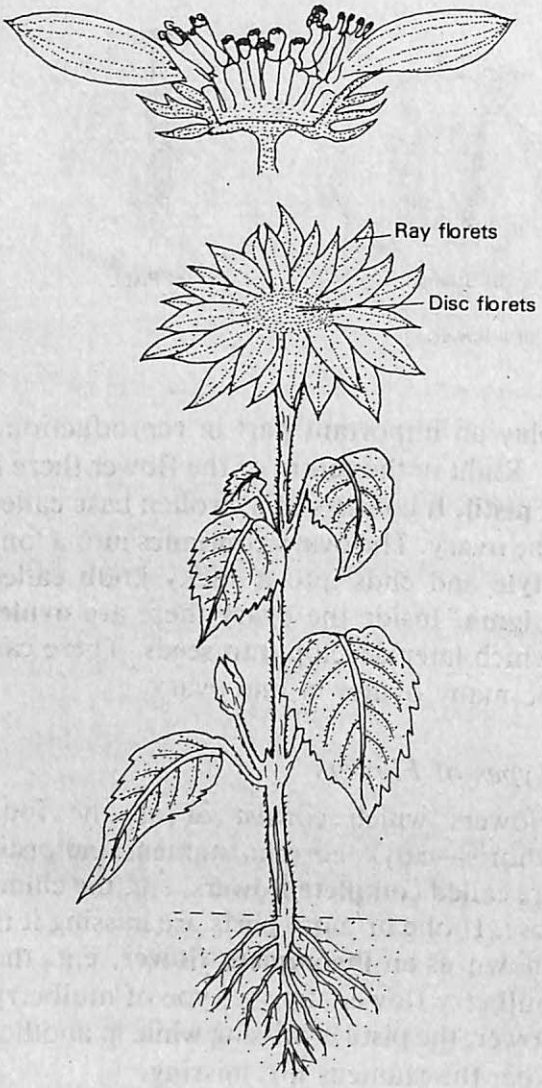


Fig. 4.14 The sunflower is a cluster of many small flowers.

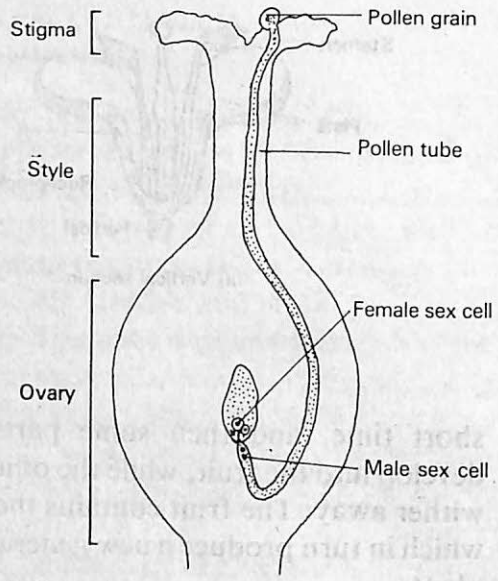


Fig. 4.15 Process of fertilization in a flowering plant.

and insects. At the same time ovules develop in the ovary.

Pollen grains from the anthers fall over or are transferred by insects, or through the medium of wind or water to the stigma of the pistil. This process is known as **pollination.** This is an important and necessary step for reproduction. The pollen grains grow into a tube-like structure carrying two special cells called **male gametes** or **male sex cells.** The tube reaches the ovule. Inside the ovule there is a **female sex cell** or an **egg.**

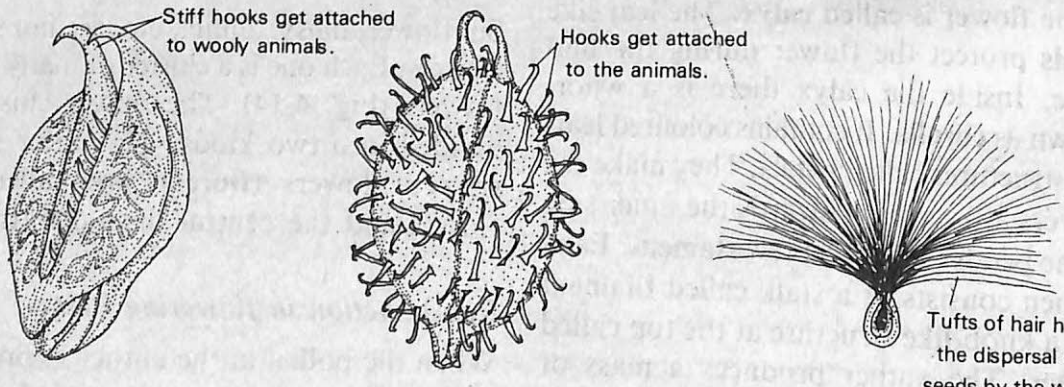
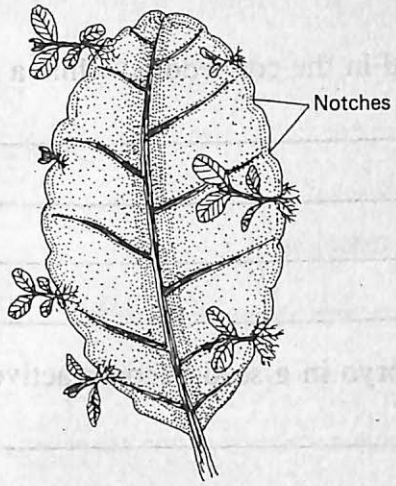
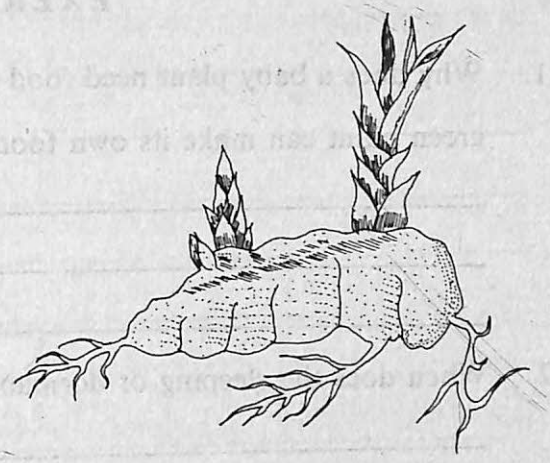


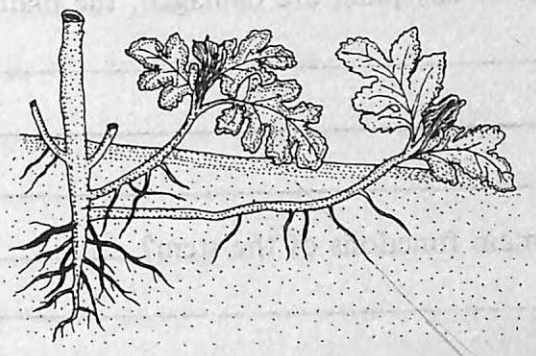
Fig. 4.16 Dispersal of seeds.



New plants arise from the leaf notches.



Vegetative reproduction in ginger (stem).



A new stem grows from the older one.

Fig. 4.17 Vegetative reproduction in plants.

One of the gametes of the pollen tube fuses with the egg of the ovule. This union of the gametes is called **fertilization** (Fig. 4.15). The fertilized egg is called **zygote**. The zygote develops into the **embryo** or the future plant. The fertilized ovule grows into the seed and the ovary develops into the fruit. By this time all the other parts of the flower fall off. Only the ovary in the form of the fruit remains attached to the plant. As the fruit matures it releases seeds, which grow into new plants. The seeds are **dispersed** by the fruit in many ways so that they spread far and wide.

The method of reproduction by seeds is known as **sexual reproduction.** Many plants can reproduce without the seeds also. This method of reproduction is called **vegetative reproduction.** This is observed in plants such as potato, sweet potato, rose, jasmine, cactus,etc.,which can reproduce other new plants of its own kind from their root, stem or leaf (Fig. 4.17).

EXERCISES

1. Why does a baby plant need food stored in the cotyledons, while a grown up green plant can make its own food?

2. When does the sleeping or dormant embryo in a seed become active?

3. When the roots of any plant are damaged, the plant dies. Explain why.

4. What are the main functions of the stem?

5. What is the difference between a simple and a compound leaf?

6. Why are the leaves of cactus modified to form spines?

7. What is the major function of a flower?

8. Explain the process of fertilization.

9. Mention the major functions of the following.

(i) Seed coat

(ii) Stomata

(iii) Cotyledons

(iv) Veins in a leaf

(v) Leaf tendril

(vi) Sepals _____

_____

_____

(vii) Petals _____

_____

_____

(viii) Anther _____

_____

_____

10. Differentiate between the following.

(i) Creeping and climbing stem. _____

_____

_____

_____

(ii) Pollination and fertilization. _____

_____

_____

_____

11. Fill in the blanks.

(i) The baby plant within a seed is known as an _____. It has a baby root called a _____ and a baby _____ called a plumule.

(ii) Monocotyledons have _____ _____

Dicotyledons have _____ _____

(iii) The vegetative organs of a plant are _____, _____ and _____. The flower is a _____ organ of a plant.

(iv) Roots which store surplus food are known as_____.
Roots which support the branches of the banyan tree are called _____ roots.

(v) The buds present at the tip of the stem are known as_____ buds. Those present in the axils of leaves are known as_____ buds.

(vi) Tissues of conducting channels in the stem are known as_____ and_____ .

(vii) Tiny pores present on the surface of a leaf are known as_____.

(viii) The four whorls (parts) of a flower are _____, _____, _____ and _____.

(ix) After fertilization, the ovary grows into the_____and the ovule into the_____.

5

Structure and Function in Animals

A car is a machine. It has several parts such as the steering, the ignition, the engine, the brakes,etc. Each part performs a different function. The car will run smoothly if all these parts work together in a coordinated way.

A human body or the bodies of other animals can be compared to machines. In fact the human body is much more efficient and versatile than any machine man has ever produced.

Like a machine, a human body also contains different parts such as the eyes, ears, nose, arms, legs,etc. These are known as **organs.**

The difference between any two animals is due to the shape, size and structure of these organs. These differences arise due to their adaptations to the environment in which they live. For example man has legs for walking, while birds have wings for flying, fishes have fins for swimming, and insects have legs as well as wings for running, walking and flying.

5.1 The Digestive System

A car runs on petrol. The petrol is burnt in the engine to provide energy to make the car run. Similarly, the human body requires food. Food provides us with energy to carry out activities of life such as movement, respiration, reproduction, thinking, etc. Organs for taking in food are different in different animals. For example in man, both hand and mouth are used for taking in food. Fishes have only mouth. A tiger uses his fierce canine teeth and fore-legs for holding the prey and tearing its flesh. Birds use their beaks for procuring food.

We take in food through the mouth. We use the teeth to chew it. It then goes into the stomach and the intestines. Here the useful portions in food are absorbed in the body. The waste material is ejected through the anus. The organs of mouth, teeth,

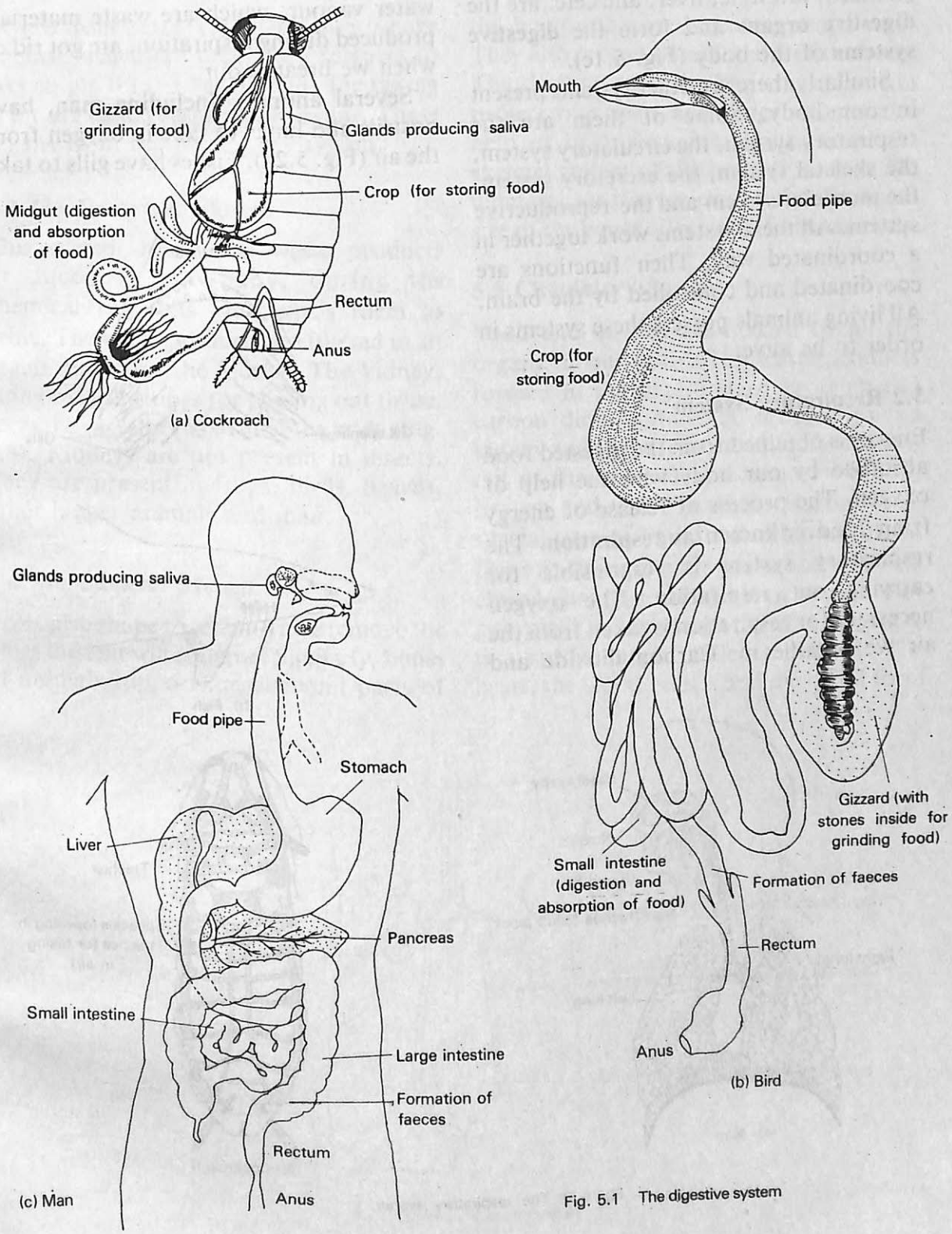


Fig. 5.1 The digestive system

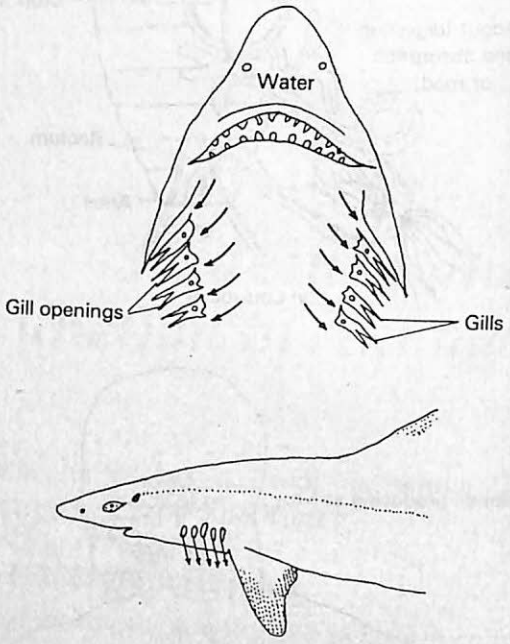
stomach, intestine, liver, anus, etc., are the **digestive organs** and form the **digestive systems** of the body (Fig. 5.1c).

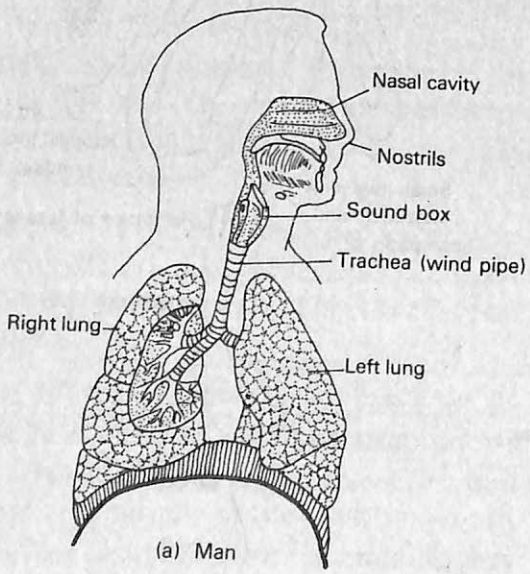
Similarly there are other systems present in our body. Some of them are the respiratory system, the circulatory system, the skeletal system, the excretory system, the muscular system and the reproductive system. All these systems work together in a coordinated way. Their functions are coordinated and controlled by the brain. All living animals possess these systems in order to be alive.

5.2 Respiratory System

Energy is obtained from the digested food absorbed by our body with the help of oxygen. The process of release of energy from food is known as **respiration.** The **respiratory system** is responsible for carrying out respiration. The oxygen necessary for respiration is taken from the air we breathe in. Carbon dioxide and water vapour, which are waste materials produced during respiration, are got rid of when we breathe out.

Several animals, including man, have nostrils and lungs to take in oxygen from the air (Fig. 5.2a). Fishes have gills to take





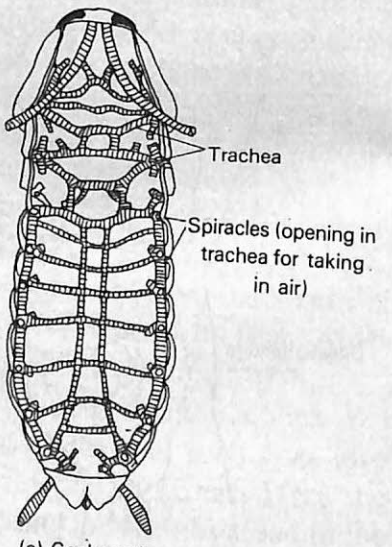


Fig. 5.2 The respiratory system

oxygen from water (Fig. 5.2b). Insects have trachea, which are tube-like structures to take in air (Fig. 5.3c). Organs for taking in air are called **respiratory organs**. These organs form the respiratory system.

5.3 The Excretory System

This system filters the waste products produced in the body, during the chemical reactions and expels them as urine. The waste products are filtered in an organ known as the kidney. The kidney, along with the tubes for passing out urine, form the **excretory system** of the body (Fig. 5.3). Kidneys are not present in insects. They are present in frogs, birds, lizards, other higher animals and man.

5.4 The Skeletal System

Poles give shape to a tent. If we remove the poles the tent will collapse. Similarly, bones of animals support the different parts of the body and give a general shape to it. They also protect the soft parts of the body. The skull protects the brain, and the ribs protect our heart and lungs. Bones also help us in movements. Bones form the **skeletal system** of the body (Fig. 5.4). All animals have this system but the shape and size of the bones differ in different animals.

5.5 Circulatory System

Food and oxygen are needed by all the organs of our body. The waste products formed in the digestion of proteins and carbon dioxide must be brought to the kidney and lungs respectively to be thrown out of the body. The transport of food, oxygen and waste products is done by a special type of liquid called **blood**. Blood flows to different parts of the body through closed channels called **blood vessels**. For pumping the blood into these vessels there is a special organ called the **heart**. The heart, the blood vessels and the blood form

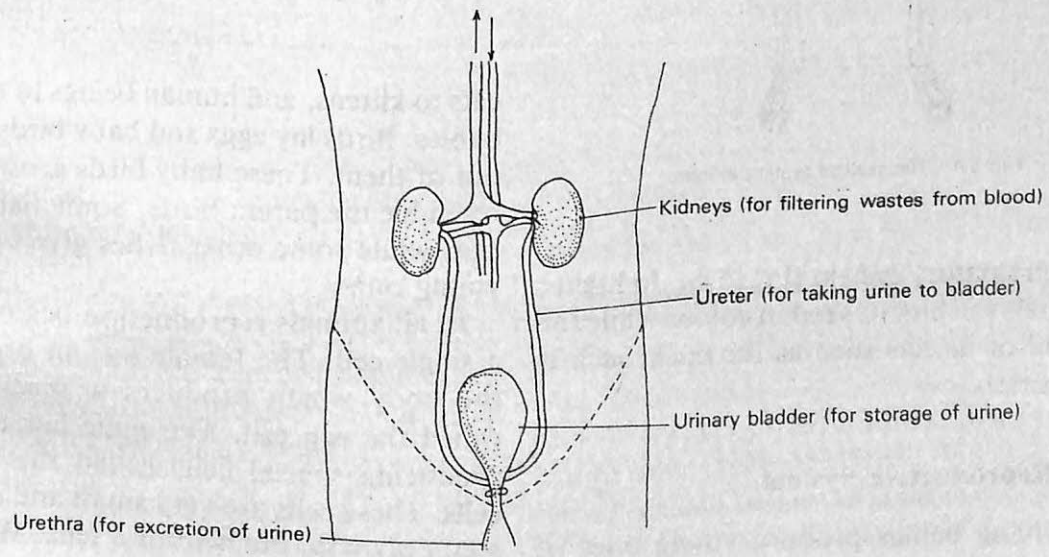


Fig. 5.3 Excretory system in man.

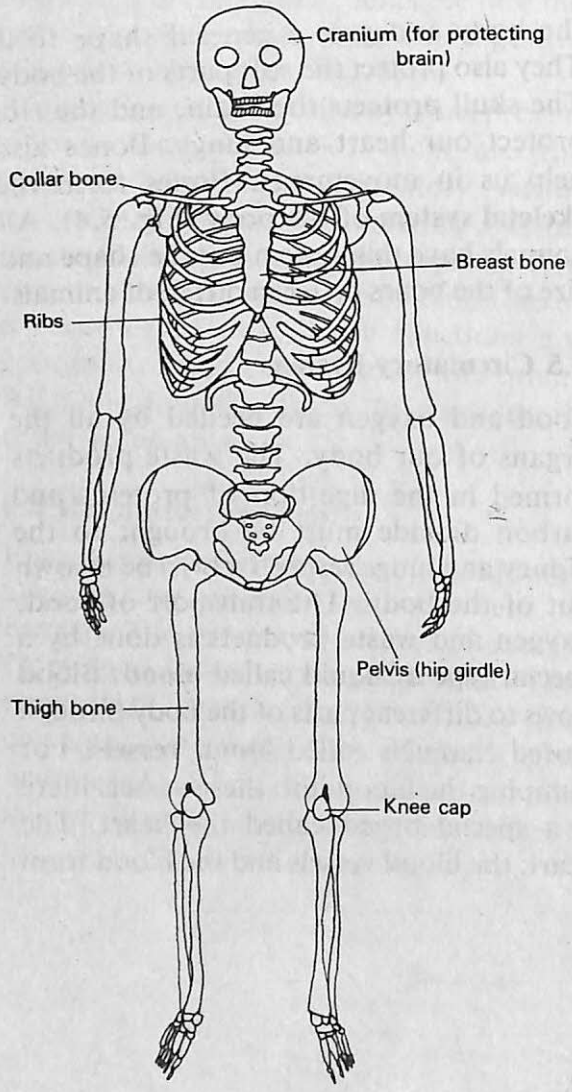


Fig. 5.4 The skeletal system in man.

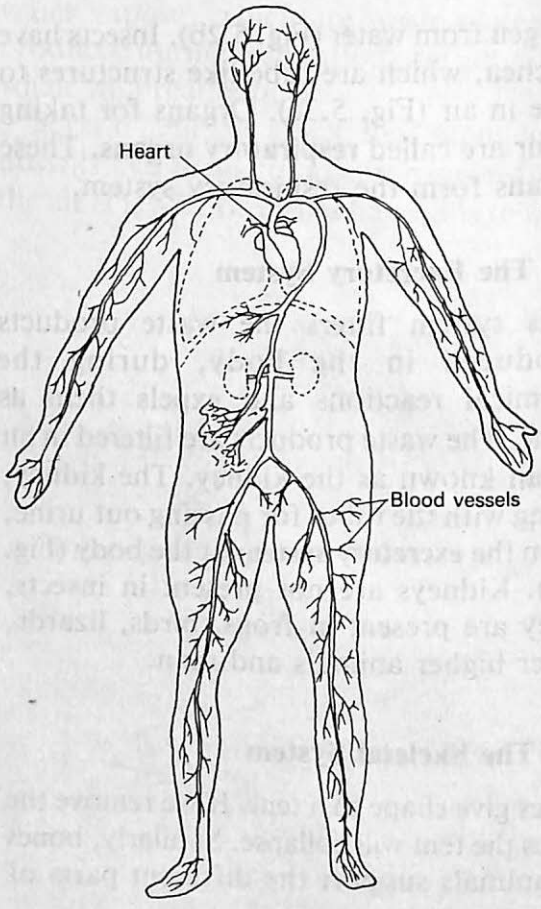


Fig. 5.5 The circulatory system in man.

the **circulatory system** (Fig. 5.5). In higher animals the blood is red in colour while the blood of insects such as the cockroach is colourless.

5.6 Reproductive System

All living beings produce young ones of their own kind. Dogs give birth to pups, cats to kittens, and human beings to human babies. Birds lay eggs and baby birds hatch out of them. These baby birds grow up to resemble the parent birds. Some fishes lay eggs while some other fishes give birth to young ones.

In all animals reproduction begins with a single cell. The female has an organ in the body which produces a special cell called the **egg cell**. The male has organs producing special cells called the **sperm cells**. These cells are very small and can be seen only with the help of a lens. When a sperm cell comes in contact with the egg

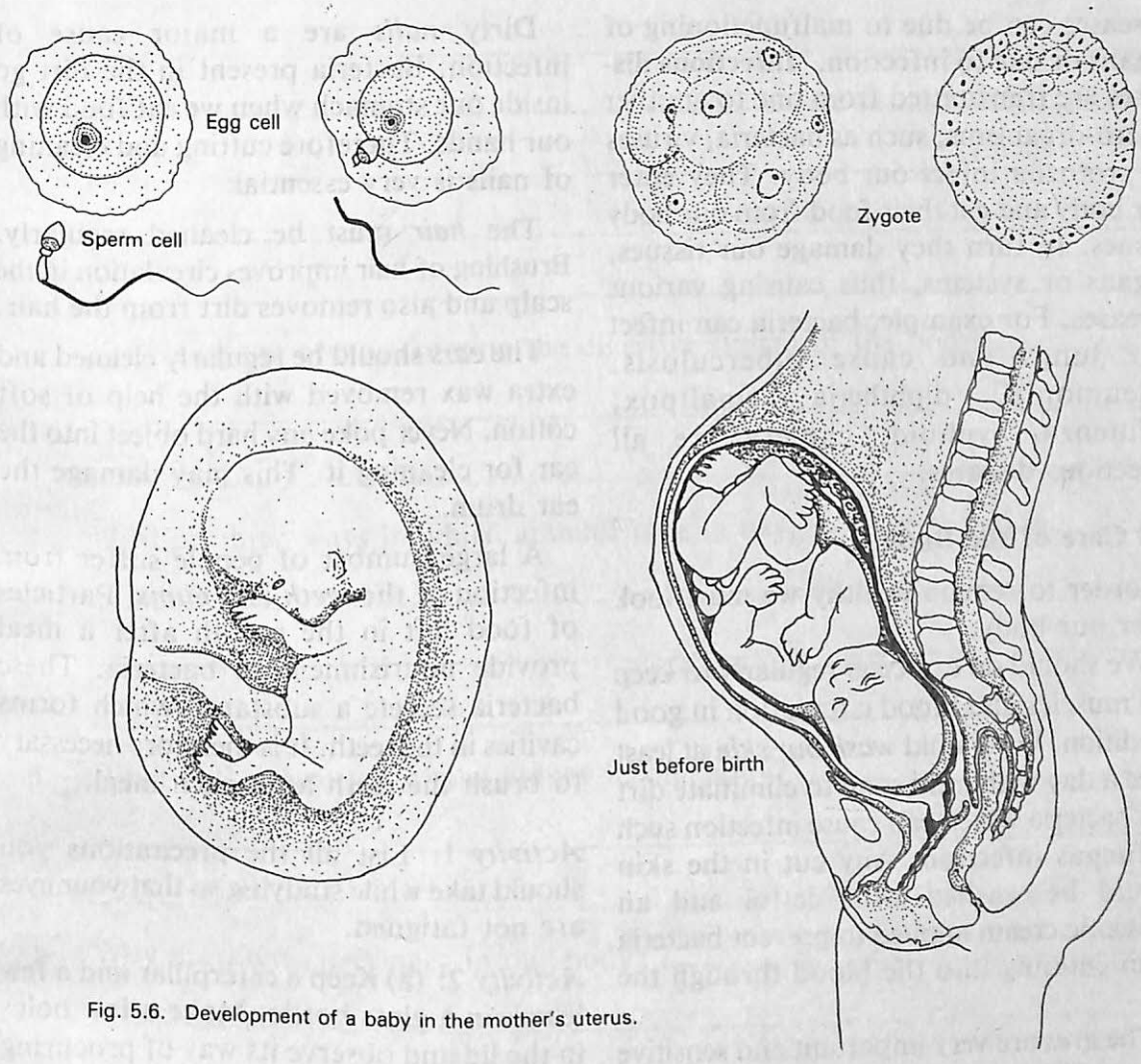


Fig. 5.6. Development of a baby in the mother's uterus.

they fuse to form the zygote which becomes a new animal (Fig. 5.6).

In dogs, cats, men,etc.,that give birth to their young ones, the zygote develops inside the mother's body in a special organ called **uterus**. When the animal is fully formed inside the uterus it is pushed out, i.e.,it is born.

You will learn about the other systems in the body in higher classes.

5.7 Diseases

In order to keep the body in good condition, all the body organs should work efficiently. If any organ does not function properly, it is said to be diseased. Diseases can be recognized by certain outward indications called **symptoms**. Symptoms can be fever, pain, weakness, indigestion, etc. Fever can be due to many reasons or different diseases. Fever itself is not a disease but is the result of a disease.

Diseases can be due to malfunctioning of organs or due to infection. **Infectious diseases** are transmitted from one to another Micro-organisms, such as bacteria, viruses or protozoa infect our body. They enter our body and get their food from our body tissues. In turn they damage our tissues, organs or systems, thus causing various diseases. For example, bacteria can infect our lungs and cause tuberculosis. Pneumonia, diphtheria, smallpox, influenza, typhoid, cholera are all infectious diseases.

5.8 Care of the Body

In order to remain healthy we must look after our body.

We should do *exercises* regularly to keep our muscles and blood circulation in good condition. We should *wash our skin* at least once a day with mild soap to eliminate dirt and bacteria which can cause infection such as fungus infection. Any cut in the skin should be washed with dettol and an antiseptic cream applied to prevent bacteria from entering into the blood through the cut.

The *eyes* are very important and sensitive organs. We should clean them regularly with clean water. We should never rub them with dirty cloth or hands. They should not be exposed to very bright light. We should ensure sufficient light while reading.

Dirty *nails* are a major cause of infection. Bacteria present in the dirt go inside our stomach when we eat food with our hands. Therefore cutting and cleaning of nails is very essential.

The *hair* must be cleaned regularly. Brushing of hair improves circulation in the scalp and also removes dirt from the hair.

The *ears* should be regularly cleaned and extra wax removed with the help of soft cotton. Never poke any hard object into the ear for cleaning it. This may damage the ear drum.

A large number of people suffer from infection of the *teeth* and *gums*. Particles of food left in the mouth after a meal provide nourishment to bacteria. These bacteria secrete a substance which forms cavities in the teeth. It is therefore necessary to brush the teeth after each meal.

Activity 1: List all the precautions you should take while studying so that your eyes are not fatigued.

Activity 2: (a) Keep a caterpillar and a few leaves in a glass bottle. Make a few holes in the lid and observe its way of procuring food.

(b) Take another caterpillar in another bottle and cover it with a lid without making any hole. Observe the catepillar after a few days (2-3 days). If it dies give reasons for its death.

EXERCISES

1. (i) Briefly explain the process of digestion in man. _____

(ii) Name the organs forming the digestive system of the body.

2. Mention three ways in which animals take in oxygen for respiration.

3. What is the function of the kidney in our body?

4. Why are bones necessary in our body?

5. (i) How is the flow of blood maintained in the body?

(ii) Why is continuous flow of blood necessary in the body?

6. How does reproduction begin in animals? _____

_____

_____

_____

_____

7. (i) Is fever a disease? _____

_____

(ii) What are infectious diseases caused by? _____

_____

_____

_____

(iii) Name three infectious diseases. _____

_____

(iv) How can dirty nails lead to infectious diseases? _____

_____

_____

_____

8. Fill in the blanks.

(i) The gas necessary for respiration is _____. The waste materials got rid of when we breathe out are _____ and _____.

(ii) _____ is the process of release of energy from food.

(iii) The circulatory system consists of the _____, the _____ and the _____.

(iv) When the sperm cell and egg cell fuse they form the _____.

(v) Diseases can be recognized by outward indications called _____.

(vi) Regular exercise is necessary to keep our _____ and _____ _____ in good condition.

9. State whether the following are true or false.
   (i) The functions of all body systems are coordinated by the brain.
   (ii) All animals breathe through the nostrils.
   (iii) Kidneys are not present in a cockroach.
   (iv) The shape and size of bones differ in different animals.
   (v) All animals have blood which is red.
   (vi) Tuberculosis is caused by infection of the lungs by bacteria.
   (vii) Looking directly at the sun sometimes is good for the eyes.
   (viii) The best method to remove extra wax from the ear is to use a wooden stick.

6

Food and Health

All of us are fond of good food. Can you make a list of the food items that you like best? Each one of you will have your own preferences. In some western countries meat forms a principal item in the daily diet. In other places, such as in our own country, rice and wheat are the examples of staple food. All of us have different tastes. Children like to have chocolates and ice creams. Several people may like to have vegetarian food while others prefer non-vegetarian preparations. All of us take food every day. If we do not eat continuously for a few days we become weak and lose weight, and may even die. It is certain that we must all take food in order to live.

All living organisms need food. Plants, insects, birds, worms, fishes, dogs, cats, man, etc. all need food. Most plants can manufacture their own food from simple substances such as carbon dioxide and water, with the help of chlorophyll and sunlight. This process of making food by plants is called photosynthesis. Animals cannot make their own food. They obtain essential food elements by eating plants or other plant-eating animals.

Different animals eat different kinds of food. Earthworms swallow soil, most insects suck plant juice, mosquitoes suck the blood of animals, birds feed on small worms and insects. Animals such as horse, deer and sheep are vegetarians, while others such as lion, tiger, jackal and wolf eat the flesh of other animals.

The manner in which different animals eat their food is also different. For example the kingfisher bird swallows fish and does not chew it. Similarly frogs and toads also swallow insects without chewing them. But man and other animals who have teeth use them for breaking the food into smaller particles and chewing it. The number of teeth, their shape and size varies in different animals.

6.1 The Need for Food

Our body needs energy to carry on all its life activities. If we do not take food for a day or two, we will not be able to do any

physical work such as walking, playing etc. Just as petrol provides energy to a motor car *food provides us with energy to do work*. We use more energy when we are running or walking, but use less energy while sleeping. Even while sleeping we require energy to maintain body processes such as respiration and circulation.

You have all seen a baby growing bigger, a seedling growing to form a plant, a kitten growing to form a cat and a pup growing to form a dog. All living things grow. Living beings are made up of a complex substance called **protoplasm**. Growth is always due to the formation of more protoplasm. *It is the food that we take in that gets transformed to make the protoplasm, and hence causes growth.*

Whenever there is a cut or wound in your body, after some days the worn out parts get replaced and repair of the damaged area takes place. The wound does not remain open for ever. It gets covered by the formation of new cells, which form the new skin over it. *Food is essential for the replacement of the worn out parts and for the repair of various parts of the body.*

We therefore see that we need food for growth, maintenance and repair of our body. We also know that food gives us energy to maintain body processes and to carry on our daily activities.

6.2 Nutrients in Food

Our food contains substances essential for our body. These are called **nutrients**.

Carbohydrates

Our main food is either rice or wheat. Bread and chappati are made out of wheat. Besides, we take potatoes, tapioca, milk, fruits, etc. All these food items contain substances called **carbohydrates.** The main function of carbohydrates is to provide energy to the body. Carbohydrates are mainly of two types. They are starches and sugars. Starches are abundant in cereal grains such as rice and wheat. Potatoes and tapioca are other sources of starch. Sugars are present in various fruits and also in sugarcane stem and beet root. Milk contains a type of sugar called lactose.

In an animal body excess of carbohydrate is stored as fat.

Fats

Milk products such as butter and cheese, vegetable oils such as groundnut oil, mustard oil and coconut oil, nuts and milk, all contain **fat.** Fats are also energy producing food. They produce more energy than carbohydrates.

Proteins

Meat, eggs, cheese, fish and various pulses such as soya beans, peas, etc., contain substances called **proteins.** Their main function is to build protoplasm in the cells. Proteins therefore help in the growth and repair of body cells and tissues.

Vitamins

Besides carbohydrates, proteins and fats, our body requires certain substances called **vitamins** in very small quantity. Vitamins are present in almost all different types of vegetables, whole grains, milk, meat and fish. Vitamins are essential for the proper growth of the body and also for the maintenance of health. Without vitamins many chemical reactions in our body will not take place. There are a number of vitamins such as Vitamin A, Vitamin B,

TABLE 6.1

Vitamin	*Present in*	*Essential for*	*Deficiency disease*
Vitamin A	Milk, butter, cheese, tomatoes, carrots, cod-liver oil.	Eyes, lungs	Night-blindness
Vitamin B Complex (mixture of several vitamins)	Milk, eggs, cheese, meat, liver, husk of cereals and pulses.	Nerve, digestion, growth	Beri-beri (nervousness, loss of appetite, paralysis)
Vitamin C (ascorbic acid)	Citrus fruits (orange, lemon, lime), green vegetables, tomatoes.	Muscles and teeth	Scurvy (bleeding of gums and swelling of joints)
Vitamin D	Milk, yellow of egg, liver, oils.	Bones	Rickets (decaying teeth, weak, distorted bones)
Vitamin K	Green vegetables	Blood clotting	

Vitamin C, Vitamin D, Vitamin E and Vitamin K. If the vitamins are lacking in our diet we may suffer from certain diseases called **deficiency diseases.** Table 6.1 provides necessary information about vitamins.

Mineral Salts

Mineral salts are important for the body functions. They are required in small quantities and are obtained from the food we take in. About 5% of the weight of the human body is composed of mineral salts. Salts of calcium and phosphorus are required for the formation of bones and teeth. Iron is essential for manufacture of **haemoglobin** in the red blood cells. These salts are present in green vegetables such as spinach, coriander, etc., fruits, milk, cheese, meat and eggs. Table salt (sodium chloride) is taken directly along with the food.

Water

Water is very essential for the living world. It forms about 70 per cent of the weight of our body. Water dissolves food and helps in the absorption of the digested food. It also helps in the excretion of waste products from the body. In addition to the water we drink, we get water from various other food materials such as fruits and vegetables.

6.3 Balanced Diet

In order to remain healthy our daily diet should include sufficient quantity of proteins, carbohydrates, fats, minerals and vitamins. One particular kind of food may not be able to supply all these. Thus a mixed diet is necessary. A variety of food that contains the right amount of various nutrients can be called a **balanced meal.** Such balanced meals taken during the course of a day make up a **balanced diet.**

The amount of various nutrients required by our body varies according to the need of the individual. It depends on his age, nature of work, health condition, etc. A person who does physical labour needs to include more carbohydrates and fats in his diet, because he needs more energy. A young growing person must take

more proteins as it helps in growth. A person who is sick, requires a special kind of diet, depending upon the nature of his illness.

6.4 Preservation of Food

Food kept open at ordinary room temperature gets spoiled quickly. The principal agents that spoil food are microorganisms such as bacteria and fungi. In order to preserve food we must be able to either destroy these organisms or prevent their growth. In olden times our grandmothers used to preserve food either by drying in sunlight or by adding salt, sugar (as in jams and pickles) or vinegar, which slow down the growth of bacteria. We boil milk in order to kill the bacteria in it. Food kept in the cold as in a refrigerator, lasts longer because rate of bacterial growth is very slow, at low temperatures.

Modern methods of preserving food are **canning, freezing** and **drying** or **dehydration.**

In canning, fresh foodstuffs are enclosed in a container which is heated to kill the bacteria and sealed immediately. Canned food so prepared contains no living microorganisms. Also the nutritive value of the food is retained.

Freezing is preservation by lowering temperature. At home, food can be preserved in a refrigerator. On a commercial scale large quantities of fruits, vegetables, meat, grains,etc.,can be stored in cold storages.

Drying or dehydration is another method to prevent the spoiling of food. Food is dried under controlled conditions. Dried milk, dried peas, dried fruits such as figs or dates can be stored for many months.

EXERCISES

1. Fill in the blanks
   (i) The process by which plants make their food is called_____.
   (ii) The main function of carbohydrates is to provide_____ for the body.
   (iii) _____provides more energy than carbohydrates.
   (iv) _____ and _____ are rich in proteins.
   (v) _____ and _____ salts are present in bones and teeth.
   (vi) A young growing person must take more_____.
   (vii) In an animal body carbohydrates are stored in the form of _____ .

(viii) The right amount of food which contains the proper quantity of essential nutrients is called _____.

(ix) Lemon contains vitamin _____ which is good for your _____ and _____ .

(x) Beri Beri is caused by deficiency of _____.

(xi) People whose blood does not clot easily may be suffering from deficiency of _____ . They should eat lots of _____.

(xii) If you cannot see properly at night you should take lots of _____ .

2. Why do living organisms take food? _____

3. Name the various nutrients in food. _____

4. Name two energy producing substances present in our food. _____

5. Which components of food should be taken more by a person who does physical labour? _____

6. What is a balanced diet? _____

7. Why should we include food containing mineral salts in our diet? _____

8. Name two food materials each, containing proteins, carbohydrates and fats. _____

9. Why should we include vitamins in our diet? _____

10. What is the importance of water in our diet? _____

11. How does food get spoiled? _____

12. What are the modern methods of storing food? _____

13. Food converted into jams and pickles does not get spoiled. Why? _____

7

Adaptability to the Environment

We have seen that any living organism is affected by the living and non-living environment and also by physical factors such as temperature, humidity or rainfall. All such factors that affect the organism make up the **environment** of that organism. Living organisms are equipped in a variety of ways to be able to survive in their environment. Aquatic animals have paddle-like feet for swimming, land animals have legs for walking and running, while birds have wings for flying. Similarly we find that aquatic plants are soft, while land plants are hard and strong.

Our environment is not always the same. It changes continuously. For example the seasons change during the year, and bring about changes in temperature, humidity, types of vegetables and fruits available,etc. The environment may change because of drought, or floods, or spread of an infectious disease. Most living organisms change their ways and habits as the environment changes. For example we wear different clothes and eat different fruits and vegetables in different seasons. Birds in very cold places migrate to warmer places during winters. If it is difficult for you or any living organism to make these changes you would be very uncomfortable. For example if you were to go to USA for some time and were not able to eat American food or adjust to the cold conditions, you would find it difficult to stay there. Therefore, *to be able to live and survive in the environment, all living organisms should be able to adjust to the changes in the environment.* An adjustment, which helps a species (plant, animal or man) to survive is known as a **biological adaptation.**

7.1 Basic Rules that Govern Life

There are three basic rules that govern life on earth.

(i) Change

As we have seen above, the environment keeps on changing constantly. Some

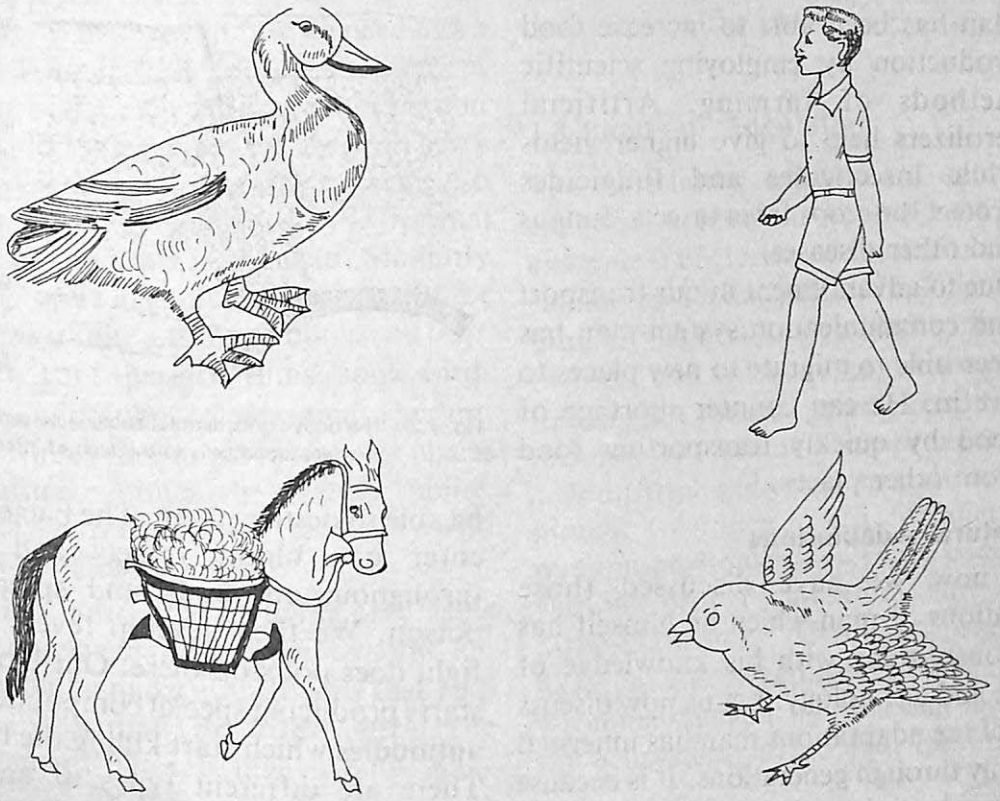


Fig. 7.1 Adaptations of feet for various modes of life.

environmental changes are caused by man himself and are now threatening his very existence. Pollution, caused by rapid industrialization, has become a serious problem. Cutting down of forests for wood and land has caused adverse climatic changes.

(ii) Interdependence

All living organisms are dependent on the environment for food, clothes and shelter. We make use of the resources of the earth i.e., water, air, forests, etc., to meet our needs.

(iii) Interaction

Living organisms are constantly interacting with the environment. They constantly come in contact with environmental resistances such as lack of sufficient food, spread of disease, floods, droughts,etc. If living organisms can successfully cope with environmental resistances they can survive.

With increasing scientific knowledge man is able to modify the environment to suit his immediate needs and overcome environmental resistances. This enables man to improve the quality of his life. Let us see how.

(i) Today drinking water is purified and garbage recyled to check the spread of diseases. Progress in medical sciences helps to prevent and cure ailments. Dams are built to preven floods and canals water our fields.

(ii) Man has been able to increase food production by employing scientific methods of farming. Artificial fertilizers help to give higher yields while insecticides and fungicides protect the crops from insects, fungus and other diseases.

(iii) Due to advancement in our transport and communication system man has been able to migrate to new places to live in. He can counter shortage of food by quickly transporting food from other places.

7.2 Natural Adaptations

Upto now we have discussed those adaptations of man which he himself has consciously done with his knowledge of science and technology. Let us now discuss some of the adaptations man has inherited naturally through generations. It is because of these adaptations that man has survived on earth.

Resistance to Disease

Bacteria and viruses are present all around us. They constantly invade our bodies and can cause diseases. Human beings have adaptations to fight diseases in order to survive. The first line of defence against infectious diseases is our skin. It does not allow bacteria to enter our body. Our stomach also secretes acids and enzymes which kill bacteria we eat along with food.

Our second line of defence are the **white blood cells** present in blood. If somehow bacteria enter our blood through a wound or through the throat, then these white cells of the blood surround the bacteria and destroy them (Fig. 7.2).

If, however, the number of bacteria are very large, the white blood cells may not

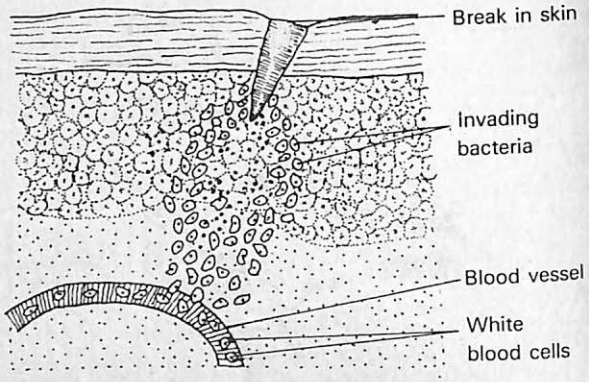


Fig. 7.2 The body fights harmful bacteria by sending armies of white blood cells to the area of infection.

be able to destroy them. The bacteria then enter our blood vessels and spread throughout our body and spread their poison. We then develop fever. But the fight does not stop there. Our blood then starts producing special compounds called **antibodies** which start killing the bacteria. There are different types of antibodies produced in our blood for different kinds of bacteria. Any kind of bacteria or virus that enters our body is known as an **antigen**. If the antibodies win and destroy the antigens the person recovers from the disease. Many other plants and animals have similar methods of defence against diseases.

Thus the body offers resistance to disease and is immune to some diseases. Strong and healthy persons have greater immunity against diseases than weak and unhealthy persons. Nowadays vaccines have been developed against various diseases such as typhoid, small pox, polio, cholera, tetanus, etc., which provide immunity to the body against these diseases.

Changes in Rhythmic Cycles

Many processes in our body occur rhythmically. The heart beats rythmically,

our sleep cycle is rhythmic and so is our breathing. When we run fast we need more energy. To meet this energy requirement the heart beats faster, to force more blood into the blood vessels so that they can carry more oxygen to the straining muscles. So to meet the immediate need the normal rhythm of the heart is changed. Similarly the sleep cycle also changes gradually for people who take up night duties.

Apart from these rhythms, some birds practice migration, a seasonal rhythm. During winter they move to warmer places and during summer they return home. These rhythms change automatically with the changing environment.

We thus notice that all living organisms *sense a change in the environment* and are usually able to make adjustments that help them to adjust or cope with the environment. Those which cannot make this change become extinct like the dinosaurs of the past.

7.3 Limits of Adaptation

There are limits to which any animal can cope with a change in the environment. For example if bacterial infection is acute man cannot resist it and suffers from the disease. Similarly animals can adjust to shortages in food and water supply within certain limits. But under severe conditions of drought and famine many of them perish.

Industrial pollution has risen beyond human tolerance. With the increase in population houses are being constructed without proper sanitation and garbage disposal facilities. All this is causing health hazards, and whether we have the environmental capacity (carrying capacity of the ecosystem) to nourish the increasing

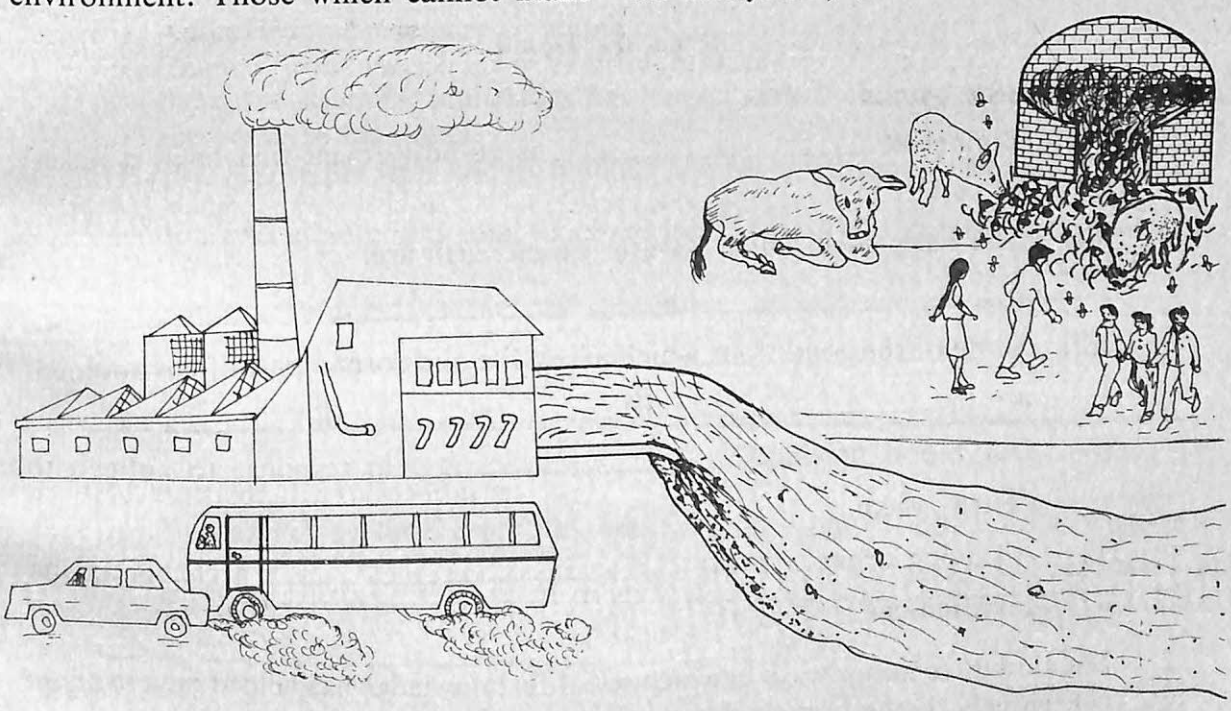


Fig. 7.3 Rapid urbanisation and industrialisation has led to alarming levels of pollution.

population has now become an important issue for mankind.

Man is dependent upon the resources of the earth and hence the quality of the environment is very important. If he destroys the environment he destroys himself.

Activity 1. Next time when you go to a far off city or village, observe the following.
(1) All changes in your environment such as water, temperature, moisture, vegetation, pollution, animals, people of that place, language, cultural activities, scenic beauty, transport, markets, etc.
(2) Make a list of the food available. Observe how it is different, and your own reactions (likes and dislikes).
(3) Make a list of typical diseases of that area and note the reaction of your body to them.

(4) Interpret your interactions to find out how far you have been able to adjust to the new surroundings.

This will help you to observe the three basic rules which govern life on earth, i.e. change, interdependence and interaction.

Activity 2. Observe your house, school or neighbourhood to find out examples where plants and animals adapt to their immediate environment. For example a chameleon or a garden lizard changes colour according to their surroundings to escape from their enemies

EXERCISES

1. Fill in the blanks.
   (i) Biological _____ is an adjustment that helps a species to survive.
   (ii) The basic rules which govern life on earth are:
   (a)_____ (b)_____ (c)_____
   (iii) Some of the conditions which affect life and form a part of environment are (i) _____ (ii) _____ (iii) _____ .
   (iv) Our blood produces _____ in response to antigen to destroy them.
   (v) All living organisms can _____ a change in the environment.

2. Mention three major ways in which scientific knowledge has helped man to adapt consciously to the present day environment.
   (i) _____

(ii) _____

(iii) _____

3. Mention at least two rhythmic cycles taking place in human beings.

(i) _____

(ii) _____

4. How do birds cope up with the severe winter of very cold places such as Siberia?

_____

_____

5. Mention at least two harmful changes that man has brought in his environment.

(i) _____

(ii) _____

6. State whether the following statements are true or false.
   (i) There is no limit to which any living organism can cope up with a change in the environment.
   (ii) An environment is ever changing.
   (iii) Change in the environment is brought about by man only.
   (iv) Increased scientific knowledge has helped man to modify the environment according to his needs.
   (v) The skin is the first line of defence against infectious diseases.

7. Mention two adaptations man has inherited naturally to survive. _____

_____

_____

_____

8. Account for the following.
   (i) We take in bacteria every day with our food but do not normally suffer from any disease because of them. _____

_____

_____

_____

(ii) Increasing human population has become an environmental resistance for the human race.

(iii) You sometimes develop fever after you get hurt.

9. What are antibodies? How do they help us in fighting against diseases?

8

Interdependence and Balance in Nature

Man has cared for plants and animals from early times, to satisfy his basic needs of food, shelter and clothing. As his knowledge of plants and animals increased he learnt to get more and more benefits from them. We are so dependent on plants and animals that we cannot imagine life without them. The food we eat, the clothes we wear, the wooden tables and chairs we sit on, the medicines that cure us from diseases, are all derived from plants or animals.

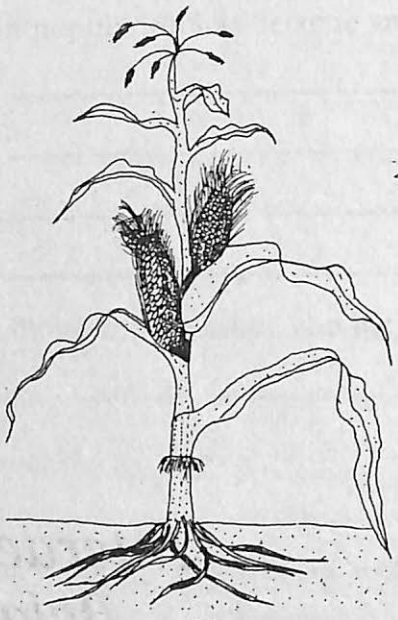
8.1 Man's Dependence on Plants and Animals

Food

From plants: **Cereals** such as rice, wheat, maize and barley form our major food. They contain a lot of carbohydrates which provide energy to the body. **Pulses** or *dals* are next in importance to cereals as sources of food. A majority of the vegetarian people in our country depend on pulses for their protein requirements. Proteins are essential for the growth and repair of our bodies. The important pulses consumed by Indians are black gram (*urad*), green gram (*moong*), lentil (*masur*) Bengalgram (*channa*), and pigeon pea (*arhar*). *Vegetables* and *fruits* provide us with all the vitamins and mineral salts which are necessary for healthy functioning of our bodies. **Spices** and **condiments** such as turmeric (*haldi*), pepper and cardamom are plant products used to flavour food. **Beverages** such as tea, coffee and cocoa are also derived from plants.

Oil seeds such as groundnut and mustard yield edible oils. They provide us with fats which give energy to the body. **Sugar** is obtained from the sugarcane plant. Many bacteria and fungi are used to produce

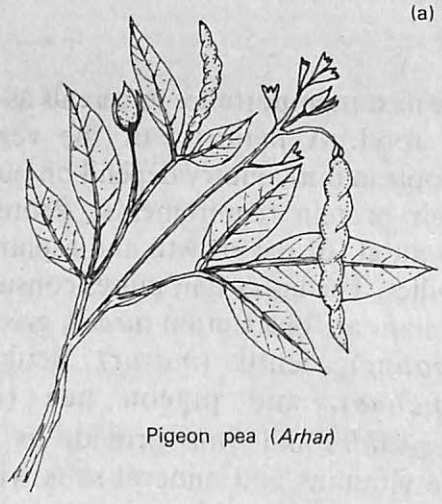
Wheat



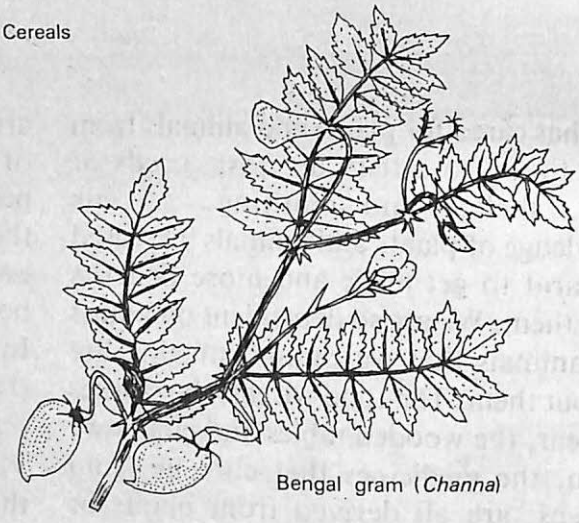
Maize

Paddy

(a) Cereals

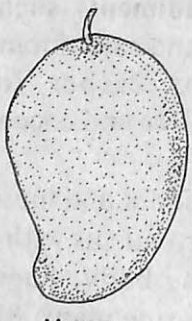


Pigeon pea (*Arhar*)

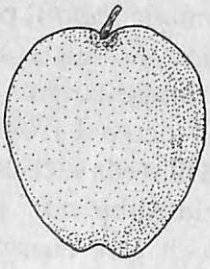


Bengal gram (*Channa*)

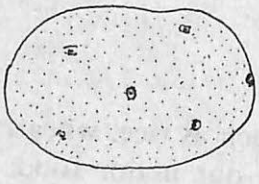
(b) Pulses



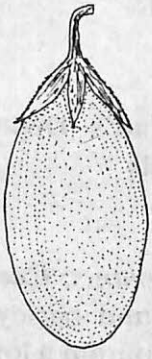
Mango,



Apple,



Potato,



Brinjal

(c) Vegetables and fruits

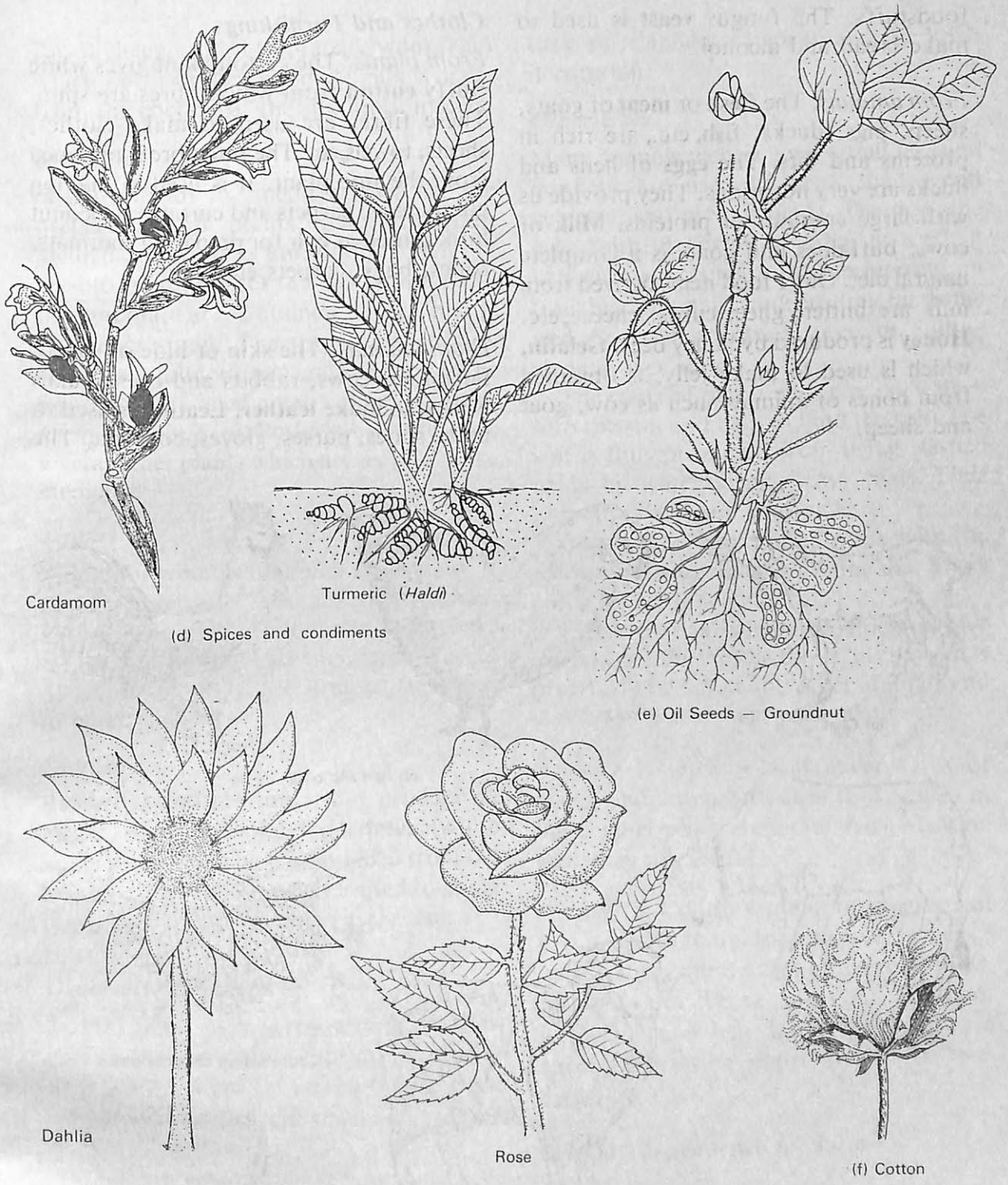


Fig. 8.1 Some useful plants

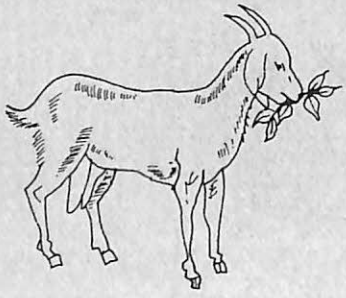
foodstuffs. The fungus **yeast** is used to make bread and alcohol.

From animals: The **flesh** or **meat** of goats, sheep, pigs, ducks, fish, etc., are rich in proteins and fats. The **eggs** of hens and ducks are very nutritious. They provide us with large amounts of proteins. **Milk** of cows, buffaloes and goats is a complete natural diet. Other food items derived from milk are butter, ghee, curds, cheese, etc. **Honey** is produced by honey bees. **Gelatin,** which is used to make jelly, is obtained from bones of animals such as cow, goat and sheep.

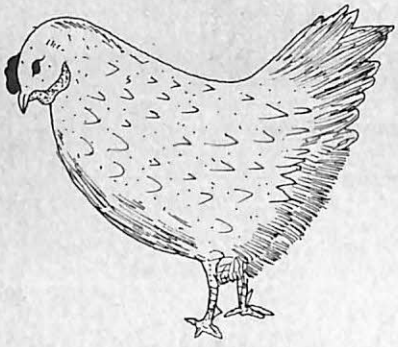
Clothes and Furnishings

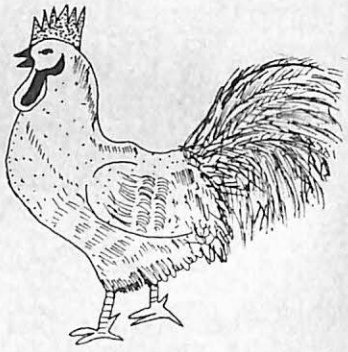
From plants: The cotton plant gives white fluffy **cotton** from which fibres are spun. These fibres are used to make clothes, sheets, towels, etc. The **jute** fibre is obtained from the jute plant. It is used in making gunny bags, carpets and curtains. Coconut husk is used as **coir** for preparing footmats, ropes, bags, carpets, etc.

From animals: The skin or hide of sheep, buffaloes, cows, rabbits and even snakes is used to make **leather.** Leather is used to make shoes, purses, gloves, coats, etc. The

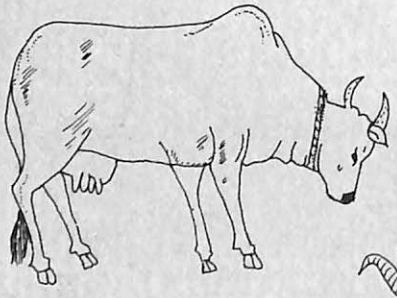


(a) Goat

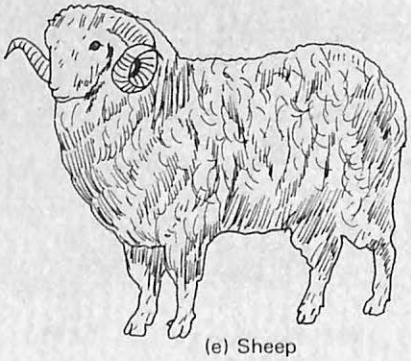




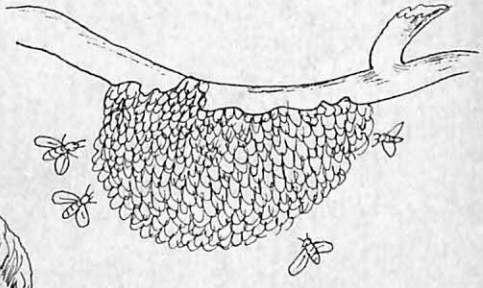
(c) Hen and cock



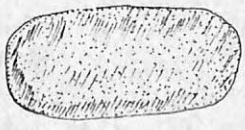
(b) Cow



(e) Sheep



(d) Beehive of honey bees



(f) Cocoon of silk moth insect.

Fig. 8.2 Some useful animals.

fur of sheep is used to prepare **wool** from which warm clothes are made. **Silk** is made from the cocoon of the silk moth insects.

Medicines

A majority of the medicines we use are prepared from plants. The important medicines known as **antibiotics** which are used to treat diseases such as typhoid and pneumonia, are obtained from plants known as fungi. The fungus *penicillium* yields the antibiotic penicillin. You must be aware of the medicinal values of *tulsi, neem, turmeric*,etc. Besides these there are several other plants which are used to make medicines.

Timber

Timber or **wood** is obtained from trees. It is used to construct houses, furniture, ships and various other products. In India teak, sal, walnut and pine are the major sources of wood. Wood is also used as **fuel**, and in making **paper.**

Rubber

Rubber is another important product of plants. It is prepared from **latex** (white milky secretion) which is obtained from the trunk of the rubber tree. It is used to make tyres, shoes, mattresses, erasers, etc.

Decorative Products

Several plants such as roses, ferns, dahlias, chrysanthemums and tulips are grown for their beauty. Some flowers such as rose and jasmine have a pleasant smell and are used to make perfumes.

Decorative products such as corals, shells and pearls are obtained from animals. Horns of some animals and the tusk of elephants (ivory) are used for decoration.

Other Uses

Many animals such as horses, bullocks and donkeys are used to carry loads, pull vehicles, and plough fields. The dog, the ever faithful friend of man, is used in various ways. It helps man in hunting, in tracking criminals, in protecting his home and, in cold countries, even in pulling sledges over snow.

The roots of plants and trees grow deep into the soil and help to bind the soil. The soil is thus prevented from being washed away by water during heavy rains. Thus plants prevent soil erosion.

Dead plants and animals mix with the soil and provide nutrients to the soil. These are used by other plants.

Plants take in carbon dioxide and give out oxygen during the day. This oxygen is breathed in by man and other animals and is necessary for their survival.

Activity 1: Observe and make a list of plants and animals besides those given in this chapter which are useful to us. Mention how they are useful.

Activity 2: Collect samples of the parts of plants useful to us, for example, leaves of neem, tulsi, mint, and flowers of rose, jasmine, etc. Press them in folds of newspapers. When dried, fix them on a sheet of drawing paper. Write the uses against each.

8.2 Interdependence in Nature

Look around your houses, school or any garden or field. The living and non-living surroundings you can see form your

environment. You and other living beings grow up in the environment and are influenced by it. The environment is made up of two groups: the group of living things such as animals and plants; and the group of non-living things such as soil, water, air, rocks, walls of your house, etc. Both the groups are closely related to each other and are dependent upon each other. Let us see how.

All green plants use sun rays to prepare their food. They use solar energy to combine carbon dioxide taken from air and water and salts brought up by the roots, to manufacture food in the form of sugars and starches. Food is manufactured in the presence of a green pigment called **chlorophyll** present in leaves. The whole process is called **photosynthesis**. During this process oxygen is given out by plants. This oxygen is available to us in air for breathing. *Thus plants are dependent upon the non-living environment to prepare their food.*

Now let us see how animals are dependent upon green plants. We eat vegetables, fruits, cereals, pulses, etc., which we get from plants. You would also have seen cattle eating grass and other plants. Thus *the food manufactured by the plants is eaten by man and animals*. We also eat the flesh of other animals. The food we eat is converted into energy in our body with the help of oxygen we breathe in from the environment. We thus get energy for our life activities. In the process, we breathe out carbon dioxide which is used by plants for photosynthesis. Thus we see that we human beings are dependent upon plants and animals as well as on the non-living environment. There is complete interdependence of plants, animals and the non-living environment. We live in coordination. There is give and take among all living and non-living things.

The Ecosystem

Any area or a place where living organisms and non-living things are working together, exchanging the materials necessary for life and using them again and again, is known as an **ecosystem.** It may be a forest, a garden, or a field, river, pond or a lake. An ecosystem consists of four parts.

1. *Non-living part or non-living environment* consisting of soil, water and air.
2. *Green plants* which manufacture food for animals. These are called food makers or **producers**. They supply food to all living organisms.
3. *Consumers:* Animals which feed directly on plants are called *primary consumers*, e.g., goat or cow. Goat's meat is eaten by man. Thus man is a *secondary consumer*. Man thus depends on grass indirectly. Animals which eat only plants, for example goats, are known as **herbivores**. Those animal such as lion, which feed on other animals are known as **carnivores.** Man eats both plants and animals, and is known as an **omnivore**. Large carnivorous animals such as the lion feed on other animals such as goat, cow, zebra, etc., which themselves feed on grass. This kind of relationship is known as a **food chain** of that particular ecosystem (Fig. 8.2).
4. *Decomposers:* Minute living organisms such as bacteria and fungi feed on dead animals and plants and convert them into natural manures or other substances which can again be used by plants from the soil. Without decomposers all dead

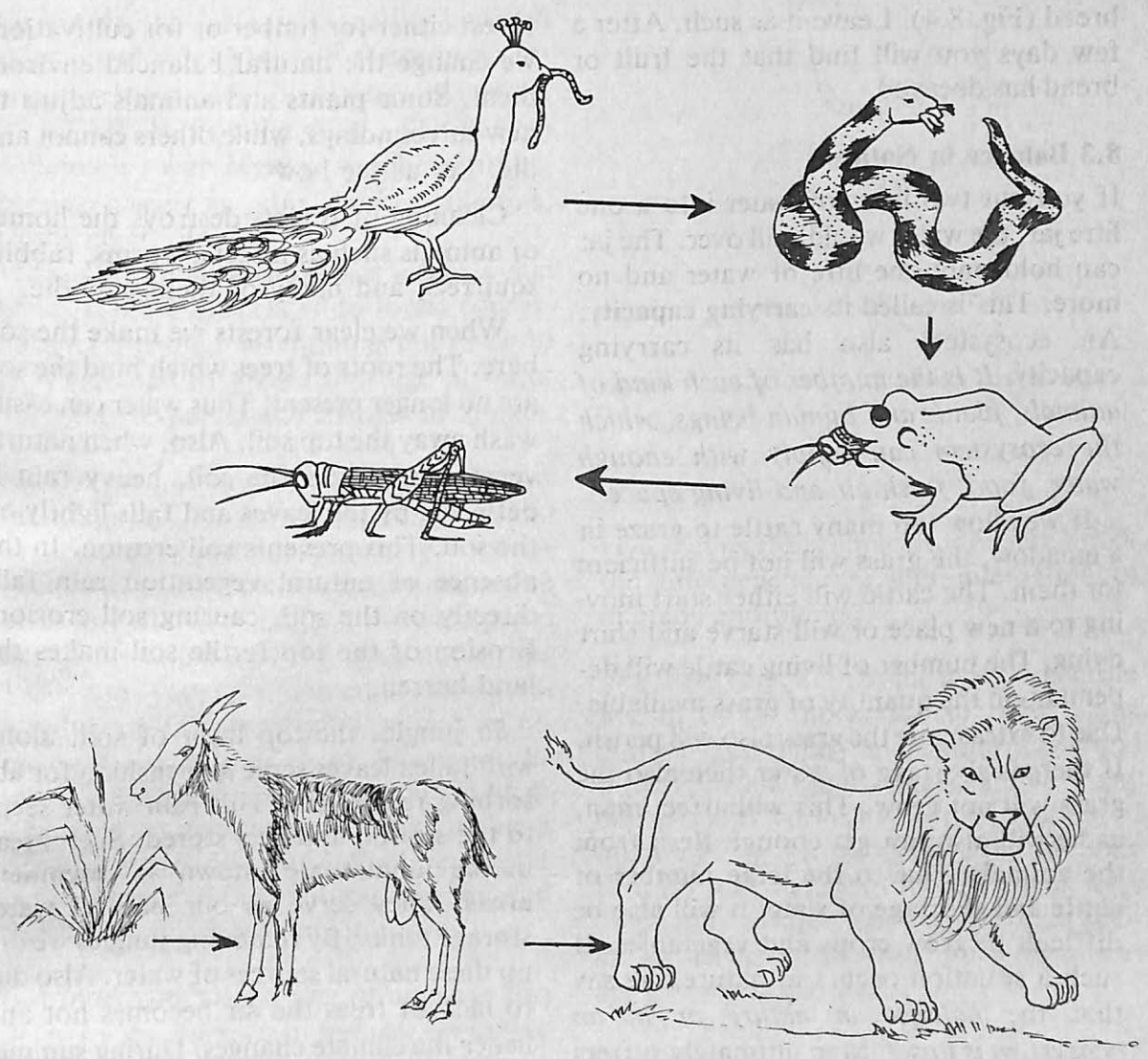


Fig. 8.3 Food chain.

plants and animals will pile up and there will be no place for the new plants and animals to grow. Besides, all important materials such as minerals, will remain locked up in dead plants and animals and will not be reused.

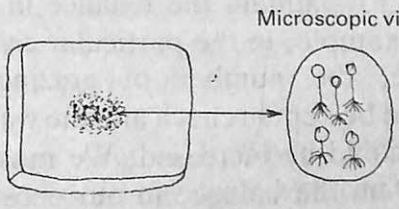


Fig. 8.4 Fungus growing on bread.

Activity 3: *Observe the work of decomposers:* Take a piece of bread or any fruit. Spread some cheese on it to enhance the growth of bacteria and fungi. Wet it and keep it inside a cupboard in a warm place. Observe the patch of fungus on the

bread (Fig. 8.4). Leave it as such. After a few days you will find that the fruit or bread has decayed.

8.3 Balance in Nature

If you put two litres of water into a one litre jar, the water would spill over. The jar can hold only one litre of water and no more. This is called its **carrying capacity**. An ecosystem also has its carrying capacity. *It is the number of each kind of animals, plants and human beings, which the ecosystem can supply with enough water, food, fresh air and living space.*

If we allow too many cattle to graze in a meadow, the grass will not be sufficient for them. The cattle will either start moving to a new place or will starve and start dying. The number of living cattle will depend upon the quantity of grass available. Due to extra cattle the grass also will perish. If there is shortage of water then also the grass will not grow. This will affect man, as he will also not get enough flesh from the animals. Due to the large number of cattle and shortage of water it will also be difficult to grow crops and vegetables. If such a situation occurs in nature, we say that the *balance in nature or in an ecosystem is upset.* Man ultimately suffers due to this imbalance. We must therefore learn to maintain the balance in nature. For example, in the particular case given above, the number of grazing cattle should be kept in check and the water supply should be increased. We must try to maintain the balance in our ecosystems, i.e, ponds, rivers, fields, jungles, etc.,

Civilization Has Upset the Balance of Nature

(i) *Cleaning of forests:* When we clear a forest either for timber or for cultivation, we change the natural, balanced environment. Some plants and animals adjust to new surroundings, while others cannot and die. Let us see how.

Cleaning of forests destroys the homes of animals such as insects, worms, rabbits squirrels, and many of them may die.

When we clear forests we make the soil bare. The roots of trees which bind the soil are no longer present. Thus water can easily wash away the top soil. Also, when natural vegetation covers the soil, heavy rain is deflected by the leaves and falls lightly on the soil. This prevents soil erosion. In the absence of natural vegetation rain falls directly on the soil, causing soil erosion. Erosion of the top fertile soil makes the land barren.

In jungles the top layer of soil, along with fallen leaves serve as a cushion for absorbing rain water. This rain water seeps to the subsoil and gets stored. Such areas in the jungles are known as **catchment areas.** They serve as our natural water storage tanks. By removing jungles we dry up these natural sources of water. Also due to lack of trees the air becomes hot and hence the climate changes. During summer there will be droughts and during the rainy season, there will be floods as water will not be soaked by the soil. Herbivorous animals will not get plants to eat. They will start dying or will encroach on our fields to feed on the crops. The carnivorous animals such as tigers and lions will move away to other places. There will be competition among animals to get food. The stronger ones will survive and the weaker ones will die. The population of animals will thus decrease.

Some useful birds will also die. These birds help the farmers by eating harmful insects and rats. This will result in an increase in the population of rats and insects, which will destroy the crops. This in turn will reduce our regular supply of forest products such as gum, timber, tannins, resins, dyes, etc.

Thus we find that **soil conservation** is vital to us. It is closely related to forest conservation. If enough attention is not given to it, it can lead to severe shortage of water and other resources and changes in climate.

(ii) *Use of insecticides:* Man has also affected the ecosystem by using fungicide and insecticides indiscriminately. These chemicals at times kill useful insects and birds as well. An example is the widespread use of insecticides in the USA during the 1950s and 1960s. The immediate effect was a reduction in pest population and an increase in the yield of crops. However, the insecticides also poisoned and killed birds who feed on insects. As a result, the next generation of pests multiplied even faster in the absence of their natural enemies, and damage to crops was much more.

(iii) *Indiscriminate killing of animals* also destroys the balance in nature. By killing large number of tigers, the number of herbivores such as, deer, will increase. These will encroach on our fields and destroy the crops.

8.4 Interdependence and Interaction

We come to the conclusion that various species of plants and animals in any ecosystem interact among themselves and interdepend upon each other. Thus they try to adjust in an environment and try to survive. Let us study some of the examples of the interdependence and interaction of animals and plants.

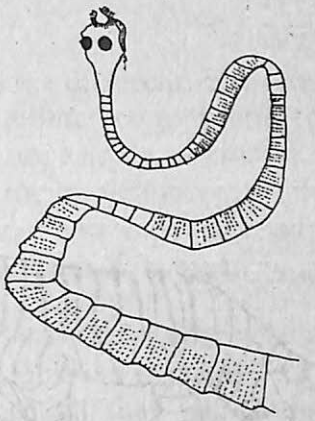
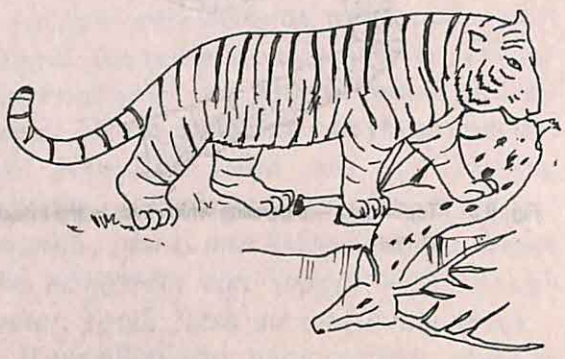


Fig. 8.5 Tapeworm — a parasite which lives in the intestines of man.

Parasites (Fig. 8.5): Some living organisms live in or on the bodies of other living animals and plants and obtain their food directly from them. For example many bacteria and worms live in the intestines of human beings. Rat-fleas live on the body of a rat and suck its blood. Fungus lives on plants causing disease to the plant such as the rust disease in wheat. Such organisms are known as **parasites.**

Predators (Fig. 8.6): Bigger animals eat smaller animals to survive. The bigger animals are known as **predators.** The lion preys on the antelope while birds such as the eagle preys on rats.

Symbiosis (Fig. 8.7): Some plants and animals live in harmony with each other. For example in our large intestine we have some bacteria which help us by providing the body with some useful chemicals. This relationship is known as **symbiosis.**



(a) The tiger preys on other animals.

(b) The eagle preys on small animals.

Fig. 8.6 Predators

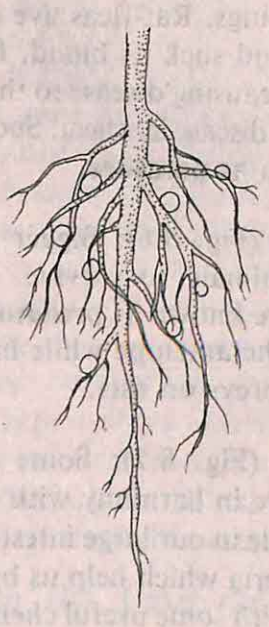


Fig. 8.7 Symbiosis — Bacteria living in nodules of some plants help them in absorption of nitrogen.

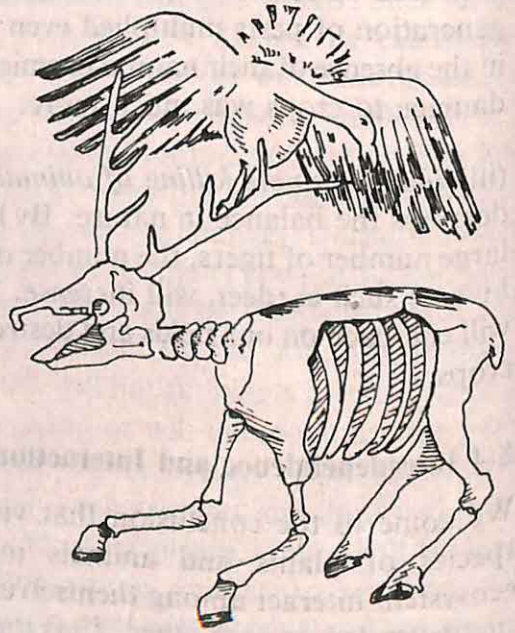


Fig. 8.8 Scavengers feed on dead animals.

Some bacteria (rhizobium) live in the roots of pea plant or pulse plant and help them in absorption of salts of nitrogen from the soil. This is another example of symbiosis.

Scavengers (Fig. 8.8): Crows and vultures feed on the flesh of dead animals while cockroaches feed on decaying vegetation.

Those of you who have travelled to various places in India or abroad would have noticed that the trees and other vegetation in different places, differ a lot. The vegetation in Kashmir differs a lot from the vegetation in Kanyakumari. Even the animals are different. Such distinctive plant and animal communities or large ecosystems are known as **biomes.** For the survival of the human race, it is necessary that we try our best to conserve our biomes and to keep them balanced.

Activity 2: Select a tree near your house or school and observe it closely for several days. Record all that you notice about other living creatures such as birds, insects, squirrels, etc., which either live on the tree or visit it. Obseve how the tree and the other living creatures are dependent on each other.

EXERCISES

1. How are vegetables and fruits useful to us? _____

2. From where is gelatin obtained? _____

3. Mention some plants which provide us with medicines? _____

4. (i) What do you mean by environment? _____

   (ii) Why is a study of our environment relevant? _____

5. Plants produce food for the entire living world. Discuss.

6. What do you mean by an ecosystem?

7. Explain the following.

(i) Producers

(ii) Primary consumers

(iii) Secondary consumers

(iv) Decomposers

8. In what ways has man upset the balance in nature?

9. Why does soil erosion take place when forests are cleared? _____

_____

_____

_____

10. Why is there so much stress on conservation of predators such as the tiger and lion? _____

_____

_____

_____

11. Explain with an example.

(i) Parasites _____

_____

_____

(ii) Predators _____

_____

_____

(iii) Symbiosis _____

_____

_____

(iv) Scavengers _____

_____

_____

12. Fill in the blanks.

(i) Pulses provide us with _____ .

(ii) Spices and condiments are used to _____ food.

(iii) Eggs are rich in _____ .

(iv) _____ is a complete natural diet.

(v) Coir is obtained from _____ .

(vi) The number of each kind of animals, plants and human beings, which the ecosystem can supply with enough water, food, fresh air and living space is called the _____ _____ of the ecosystem.

(vii) If there are no _____ all dead plants and animals will pile up and there will be no place for new plants and animals to grow.

13. Mark true or false.

(i) Cotton and jute are obtained from animals.

(ii) Wool is obtained from the fur of sheep.

(iii) Penicillin is made artificially in the laboratory.

(iv) Wood is used to make paper.

(v) Latex, which is used to make rubber, is obtained from the trunk of trees such as peepal or mango.

(vi) Corals and shells are plant products.

(vii) If there were no plants the amount of oxygen in the air would go on decreasing.

(viii) Living organisms are dependent upon each other and not on non-living things.

(ix) If a swarm of locusts destroy the crop in a farm it will upset the balance in the farm ecosystem.

(x) Clearing of forests can lead to change in climatic conditions.

(xi) The only effect of soil erosion is to reduce the fertility of soil.

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